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"The current interest in general education among professional groups like the pharmacists is an acknowledgement that higher education must not only prepare men and women for the peculiar activities of their own vocational group, but that it must also prepare them for the other activities which they have in common with their countrymen in all walks of life. If this educational goal is to be reached, the present courses of study must be augmented by units of nonprofessional subject matter." —Earl J. McGrath

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***Number 1***

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## Student Personnel Studies of the Pharmaceutical Survey

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**The Pharmaceutical Survey, American Council on Education**

"Achievement and Predictive Testing in the Pharmaceutical Survey," *American Journal of Pharmaceutical Education*, XI (January 1947), 43-53.

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"Inquiry Concerning Student Personnel Procedures in Colleges of Pharmacy," *AJPE*, XIII (January 1949).<sup>3</sup>

"Measuring the Achievement of Pharmacy Seniors," *AJPE*, XIII (January 1949).<sup>3</sup>

"Pharmacy State Board Examinations Are Obsolete," *AJPE*, XIII (January 1949).<sup>3</sup>

"The Future of Student Personnel Problems in Colleges of Pharmacy," *AJPE*, XIII (January 1949).<sup>3</sup>

<sup>1</sup> The authors were on part-time leave from Purdue University to carry out the studies.

<sup>2</sup> These five papers reprinted as Pharmaceutical Survey Monograph No. 3 in a single volume entitled **Student Personnel Studies of the Pharmaceutical Survey** by H. H. Remmers and N. L. Gage (Washington: American Council on Education, 1949).



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## Introduction

The various student personnel studies of the Pharmaceutical Survey were carried out over slightly more than a two-year period—from July 1946 to September 1948.

The predictive and achievement testing program, originally conceived and outlined by Dr. Carl Klemme and myself in 1937, and presented to the American Council on Education in 1937 as a memorandum, is still unfinished business, as the reader will find repeatedly in a number of the papers, but especially in III, "Measuring the Achievement of Pharmacy Seniors," and V, "The Future of Predictive and Achievement Testing in Pharmacy." Hence, the record here will be of great use and convenience if the project of prediction against the criterion of a carefully conceived objective measurement of senior achievement is finally completed.

The Pharmaceutical Survey was originally conceived as a three-year project and, therefore, did not provide the necessary time interval to test entering freshmen in 1946 in order to study the predictiveness of the tests in 1950, when the 1946 freshmen who survived would, for the most part, be seniors. The desirability of thus testing the tests, while not provided for in the scope of the Survey as planned, is too obvious to need elaboration here. A major part of the scientific value of the whole program will have been sacrificed if the test validation is not carried through to completion.

That what has thus far been accomplished is valuable in pharmaceutical education will be readily granted by those whose professional training and competence gives them a right to a judgment. The demonstration on a nation-wide basis that, even with such an unsatisfactory measure of achievement as semester grades, the predictive tests give substantial predictions will give immediate body and substance

to guidance, selection, and placement of students who aspire to become pharmacists. Even more valuable and important in the long run may well be the improvement of measures of achievement of seniors initiated in the Comprehensive Senior Examinations containing approximately twelve hundred objectively scored questions covering the four major areas of the pharmacy curriculum—pharmacy, pharmacology, pharmacognosy, and pharmaceutical chemistry.

The reading of some of the material here presented will, I am fully aware, present rather rough going in spots where it was in our judgment necessary to make the record in the technical language of test technology and statistics. For those who will have to take the adequacy of the techniques for granted, we have attempted to point up the meanings in our verbal conclusions and recommendations. The scientific investigator is, however, also under obligation to make it possible for his technical peers to read his results critically; hence the technical presentation where it occurs.

It is a pleasant duty to acknowledge the personal pleasure and professional satisfactions I have gained in my association with the Pharmaceutical Survey—the opportunity to continue working with Dr. Edward C. Elliott, my chief of more than twenty years; to witness the professional devotion of all those teachers and administrators in schools of pharmacy who participated in the program; and the pleasant associations with my former student and colleague Dr. N. L. Gage—these are items of psychic income that will remain as large, permanent capital.

H. H. Remmers

November 1948



## I. Prediction of Scholastic Mortality

One criterion of the validity of the predictive test battery is how the score on each of the tests is related to withdrawals<sup>1</sup> from the schools of pharmacy. A study was, therefore, designed to determine the relationship between scholastic mortality and scores on the various tests.

The basic data were obtained by means of the following letter and questionnaire sent to all the participating schools of pharmacy.

April 6, 1948

To Deans of Colleges of Pharmacy:

As an additional validation of the Predictive Testing Program of 1946, Dr. Edward C. Elliott has directed this office to secure from your institution, as one of those that participated in this program, the (1) names of the freshmen tested then who have since withdrawn or been dismissed from the college of pharmacy, (2) time of leaving, and (3) reason for leaving.

The enclosed will, we hope, facilitate your supplying this information to us.

Allow me to thank you in advance for your cooperation.

Cordially yours,

H. H. Remmers, Director  
Student Personnel Studies

<sup>1</sup>Withdrawals for all reasons: those at the initiative of the student, such as change of interest, inadequate health, etc.; and those at the initiative of the college, such as elimination for scholastic deficiency, disciplinary reasons, etc.

**Names of Students Who Entered College of Pharmacy as Freshmen in the Fall of 1946 and Who Have Left the College of Pharmacy at Some Time up to December 1, 1947**

Name of Institution Reporting \_\_\_\_\_

Signature \_\_\_\_\_ Official Position \_\_\_\_\_

If your institution is on the semester system, indicate time of leaving for each student with the following code:

- A—before end of 1st semester
- B—at end of 1st semester
- C—during 2nd semester
- E—during summer session
- F—at end of summer session
- G—during fall 1947, up to Dec. 1

If your institution is on the quarter system, indicate time of leaving for each student with the following code:

- 1—before end of 1st quarter
- 2—at end of 1st quarter
- 3—during 2nd quarter
- 4—at end of 2nd quarter
- 5—during 3rd quarter
- 6—at end of 3rd quarter
- 7—during summer session
- 8—at end of summer session
- 9—during fall quarters, 1947 up to Dec. 1

Name of Student	Time of Leaving College of Pharmacy	Reason for leaving college of pharmacy (Indicate briefly such reasons as scholastic deficiency, change of interest, family problems, financial reasons, physical reasons, etc.)
-----------------	-------------------------------------	---

Usable data were obtained from 33 schools of pharmacy. The number of schools in the following tables varies because not all schools used all the tests. For each of the schools the student withdrawals occurring within the period of September 1946 to December 1, 1947, were tabulated against the scores that the students who withdrew achieved on each of the various tests. The statistic used to describe the relationship between withdrawal and scores is the biserial coefficient of correlation.<sup>3</sup>

<sup>3</sup>J. P. Guilford, *Fundamental Statistics in Psychology and Education* (N.Y.: McGraw-Hill Book Co., 1942), pp. 237-40.

The meaning of biserial correlation may be seen in Table 1. Here are the data for a typical institution on a typical test. (Institution No. 19 on the Purdue Mathematics Training Test, Form XM.) Note that the mean score (M) of the 38 students

**TABLE 1**

Biserial Correlation Data for a Typical Institution  
on a Typical Test (Mathematics Training Test in College No. 19)

Test Score	Withdrew	Remained	Total
60-63		3	3
56-59		4	4
52-55	1	1	2
48-51	1	11	12
44-47	1	4	5
40-43	1	9	10
36-39	5	11	16
32-35	3	18	21
28-31	4	15	19
24-27	8	20	28
20-23	3	10	13
16-19	6	9	15
12-15	3	1	4
8-11	2		2

N	38	116	154
Mean	27.06	33.81	32.14
S. D.			11.52

$p = .247$                        $y = .316$

$p$  = proportion of withdrawals

$y$  = normal curve ordinate at  $p$

$$r_{bi} = \frac{M_{\text{total}} - M_{\text{withdrawals}}}{S. D. \text{ total}} \cdot \frac{p}{y} = .345$$

who withdrew is appreciably lower than that of the 116 students who remained. In Table 2 are shown the data for the test in an institution where the correlation with withdrawal-remaining was much higher (.636). Here, of course, the two distributions are even more disparate. These coefficients of

correlation for all tests are shown for all institutions in summary in Table 3 (the full data for each institution on each test are given in Appendix A, Tables I-X). It is obvious from

**TABLE 2**  
Biserial Correlation Data for an Institution  
Whose Withdrawals Are More Closely Related to a Given Test  
(Mathematics Training Test in College No. 9)

Test Score	Withdrew	Remained	Total
60-63			
56-59		1	1
52-55		2	2
48-51			
44-47	1	2	3
40-43	1	4	5
36-39	6	2	8
32-35	1	3	4
28-31	2	5	7
24-27	6	2	8
20-23	8		8
16-19	4		4
12-15	1		1
8-11			
N	30	21	51
Mean	27.22	37.88	31.50
S.D.			10.16
p= .588	y= .389		
p=proportion of withdrawals			
y=normal curve ordinate at p			
$r_{bi} =$	$\frac{M_{total} - M_{withdrawals}}{S. D. total}$	$\cdot \frac{p}{y}$	$= .636$

inspection that these coefficients themselves are positively correlated with each other. For a given school they all tend to be of similar value. This means that student withdrawals as related to scholastic aptitude are consistently more predictable for some schools than for others. Scholastic aptitude is not, of course, the only factor related to withdrawals. Those fac-

tors not related to scholastic aptitude but related to withdrawals evidently operate differently in different schools.

**TABLE 3**  
Biserial Coefficients of Correlation between Student  
Withdrawals and Scores on the Predictive Tests\*

College No.	PSYCHOLOGICAL			ENGLISH				Phys.		Pharm.
	Total	Q	L	Total	I	II	III	Sci.	Math.	Bkgrd.
1	.511	.340	.477	.380	.372	.268	.290	.673	.570	.050
2	.291	.292	.020	.168	.278	.025	.146	.312	.347	.086
4	-.090	-.167	-.014	.039	-.057	.018	.038	.174	.153	.005
6	.232	.181	.166	.083	.096	.008	.137	.226	.387	-.007
9	.854	.547	.544	.549	.455	.396	.418	.752	.636	.401
10	.522	.569	.421	.277	.147	.240	.284	.502	.488	.397
11	.312	.096	.408					.304	.371	-.020
12	.184	.240	.137	.148	.306	-.005	.110	.100	.215	.277
13	.287	.083	.440	.101	.027	-.039	.262	.133	.046	.234
16	.190	.297	.025					.392	.359	.057
17	.179	.016	.206	.221	.144	.036	.310	.276	.099	.176
18	.235	.038	.321	.477	.445	.213	.515	.343	.174	-.229
19	.400	.464	.298	.338	.411	.251	.208	.429	.345	.110
20	.350	.280	.349	.215	.236	.161	.082	.233	.426	-.022
21	.544	.437	.413	.397	.332	.136	.407	.664	.316	.400
22								.413		.358
23	.073	.126	-.017	.082	-.126	.136	.082	-.149	.230	.099
24	.431	.041	.535	.406	.325	.340	.371	.276	.350	.040
25								.352	.311	.574
26				.089	.229	-.116	.148	.321	.341	.172
27	.215	.330	.093	.020	.250	-.110	-.045	.283	.322	.278
29	.569	.742	.282	.472	.162	.593	.229	.391	.705	.413
30	.830	.730	.526	.426	.642	.257	.389	.449	.464	.000
33	.575	.532	.491	.386	.508	.241	.339	.453	.356	.079
38	.343	.306	.260	.405	.470	.383	.137	.066	.242	.162
39	.201	.244	.135	.432	.528	.436	.183	.120	.278	.586
41	.484	.445	.475	.294	.248	.326	.228	.560	.635	.208
43	.311	.232	.300	.360	.390	.183	.324	.355	.441	.159
44				-.033	-.154	-.096	.014	.020	-.079	.156
45	.245	.188	.245	.084	.054	.105	.111	.379	.036	.108
46								.147		.129
47								-.009	.380	-.163
48								.003	.072	.079
Range:	-.149	-.090	.016	-.007	-.154	-.116	-.045	-.149	-.079	-.229
	.752	.854	.742	.544	.642	.593	.515	.752	.705	.586

\*Blanks indicate no data were available.

Table 4 shows the frequency distributions of the biserial coefficients listed by schools in Table 3. From the median values of Table 4, it is evident that for the typical school of

TABLE 4

Frequency Distributions of Biserial Coefficients  
of Correlation Between the Predictive Tests and  
Withdrawals from Colleges of Pharmacy

r bi	PSYCHOLOGICAL			ENGLISH			Phys.	Pharm.	
	Total	Q	L	Total	I	II	III	Sci.	Math. Bkgrd.
.85-.89	1								
.80-.84	1								
.75-.79							1		
.70-.74		2						1	
.65-.69							2		
.60-.64					1			2	
.55-.59	2	1				1	1	1	2
.50-.54	3	2	3	1	2		1	1	
.45-.49	1	1	3	2	2		1	2	
.40-.44	2	2	4	4	2	1	2	3	3
.35-.39	1			4	2	2	2	5	2
.30-.34	3	3	3	1	3	2	3	4	6
.25-.29	2	3	3	2	2	3	3	3	1
.20-.24	5	3	2	2	2	3	3	2	3
.15-.19	3	2	1	1	1	2	1	1	2
.10-.14		1	2	2	2	3	6	4	3
.05-.09	1	2	1	4	2		2	1	2
.00-.04		3	2	2	1	4	2	2	3
(-.001)-(-.05)			2	1		2	1	1	3
(-.051)-(-.10)	1				1	1		1	
(-.101)-(-.15)					1	2		1	1
(-.151)-(-.20)		1			1				
(-.201)-(-.25)									1
N	26	26	26	26	26	26	26	33	33
Median	.31	.26	.30	.27	.27	.17	.21	.31	.33

pharmacy there is a significant relationship between test scores and withdrawals; that is, withdrawals are to a significant extent predictable from the predictive test battery.

That these coefficients of correlation are not higher is



undoubtedly attributable to the fact that withdrawals occur for reasons other than scholastic deficiency. In fact, all withdrawals, for whatever reason, are included in these tabulations. We made no attempt to restrict the tabulations to only those withdrawals that were indicated by the colleges as owing to scholastic deficiency. Since the reasons given for withdrawal seemed too often to be inaccurate and vague, such restriction would have had to be both inaccurate and incomplete.

At the bottom of Table 4 are shown the median coefficients for each of the tests and subtests of the predictive testing battery. It will be noted that the Mathematics Training Test has the highest median, .33, while the Pharmacy Background Test has the lowest median, .14. The Physical Science Test and the Psychological Examination both have median coefficients of .31, while that of the Cooperative English Test is .27. The quantitative and linguistic scores of the Psychological Examination have median coefficients of .26 and .30, respectively.

Interesting but less meaningful measures of the validity of these tests against the "withdrawal" criterion are the total over-all biserial coefficients. These are shown for each of the tests in Table 5. These coefficients are all lower than the median coefficients for the corresponding tests, as shown in Table 4. This is to be expected, of course, since the schools are known to differ so widely in the average scholastic ability of their entering students. The student who is eliminated for scholastic deficiency in a high-ranking college may never have any scholastic difficulty in a lower-ranking institution. Such variation in standards serves to attenuate the "withdrawal" criterion and lower the correlation computed on the basis of combined data from all colleges.

Apart from the Pharmacy Background Test, these tests are all approximately equal in their ability to predict withdrawal from colleges of pharmacy. It should be remembered that the median coefficients of correlation of these tests with first-semester average grades for all freshmen were also approximately equal, except for the substantially lower median

of the Pharmacy Background Test. In the English Test, Part I, on English usage has a median biserial coefficient of .27, which is higher than that of Part II on spelling, .17, or of Part III on vocabulary, .21.

TABLE 5

Biserial Coefficients of Correlation between Each Test Score and Withdrawal-Remaining in All Institutions

$N_t$	= Total number of entering students	$M_w$	= Mean score of withdrawing students
$N_w$	= Number of withdrawing students	S.D.	= Standard deviation of scores of entering students
$p_w$	= Proportion of students withdrawing	$r_{bi}$	= Biserial coefficient of correlation
$M_t$	= Mean score of entering students		

Test	$N_t$	$N_w$	$p_w$	$M_t$	$M_w$	S.D.	$r_{bi}$
A. C. E. Psych. Exam., total score	2,279	525	.230	106.22	98.11	25.07	.245
A. C. E. Psych. Exam., Q-score	2,279	525	.230	40.42	37.07	11.72	.217
A. C. E. Psych. Exam., L-score	2,279	525	.230	65.80	61.04	16.89	.214
Cooperative English Test, total score	2,203	532	.241	52.89	50.63	9.41	.186
Cooperative English Test, Part I	2,203	532	.241	49.28	47.52	9.18	.149
Cooperative English Test, Part II	2,203	532	.241				
Cooperative English Test, Part III	2,203	532	.241	56.97	54.97	10.93	.142
Physical Science Test	2,762	661	.239	71.55	66.27	14.61	.278
Mathematics Training Test	2,623	636	.242	32.65	28.60	11.15	.281
Pharmacy Background Test	2,744	675	.245	27.40	25.93	6.33	.181

One of the implications of these data for future research on the prediction of success in pharmacy training is that measures of mathematical, scientific, and general scholastic ability can effectively discriminate between students who will survive the first year and a quarter of pharmacy training and those who will withdraw *for any reason*. The test of English usage,

spelling, and vocabulary is of somewhat less value. The test on spelling apparently contributes little, if anything, to the total effectiveness of the English Test. The quantitative part (arithmetic problems, number series, and figures analogies) of the Psychological Examination seems to have substantially less value than the Mathematics Training Test, which appears to measure the same kinds of ability and achievement in perhaps somewhat less artificial form. Thus, it would seem that the present predictive test battery could be shortened without the loss of predictive power for average grades and academic mortality through the omission of the quantitative part of the Psychological Examination and of the spelling and vocabulary parts of the English Test. The Pharmacy Background Test, although still promising as a measure of interest in pharmacy through information concerning pharmacy, seems at present to be of practically no value in the prediction of grades and elimination from the pharmacy curriculum.

*The Personal Data Items and Withdrawal  
from Colleges of Pharmacy*

The personal data section of the Pharmacy Background and Personal Data Blank consisted of 55 items dealing with the background and interests in school, community, and family of the freshmen entering colleges of pharmacy. These questions are of the kind generally asked in the application-for-admission blanks used by most colleges and universities. To ascertain whether the information concerning students obtained with these questions was related to the withdrawal-remaining criterion in colleges of pharmacy, item analyses were performed on all the items in all the colleges of pharmacy that furnished the names of withdrawing students.

The process of item analysis consisted of the following steps: (1) separating the answer sheets of students who withdrew from those of students who remained in the college of pharmacy; (2) determining the percentage of withdrawing students who chose each alternative response to each question of personal data and also determining the percentage of students who remained in the college of pharmacy who chose

each alternative; (3) determining a scoring weight which is proportional to the difference between the two percentages obtained in step 2. For the latter step, the *abac* prepared by Guilford<sup>3</sup> was used. This method yields a weight for each alternative ranging from 0, for an alternative chosen much more often by withdrawing than by remaining students, to 8 for an alternative chosen much more often by remaining than by withdrawing students. Alternatives that are chosen equally often by both groups are given a scoring weight of 4. Those in which the differences between percentages of withdrawing and remaining students are not so great, receive scoring weights of 2 or 3 if they are negatively discriminating, or 5 or 6 if they are positively discriminating; that is, if they are more often chosen by remaining than by withdrawing students. For example, let us consider the first response alternative to question 1:

- "1. For how long have you been considering pharmacy as a career? 1. Less than two months."

In school No. 1 this alternative was chosen by 22 percent of the withdrawing students and by 9 percent of the remaining students. The scoring weight assigned to this question-alternative response in this institution is, therefore, 3.

This approach to the determination of scoring weights for these personal data items is based on the assumption that a discriminatory, or valid, item should be one that operates effectively for a large number of colleges of pharmacy. Thus any response-alternative that emerges as discriminatory in this procedure may be considered to be correlated with withdrawal-remaining in a significant number of colleges of pharmacy. That item and response-alternative should then be generally useful for predicting withdrawal. This kind of standard for the validation of the personal data items is, of course, much more rigorous and difficult to attain than would be the use of validation data from only a single institution. That is,

<sup>3</sup>J. P. Guilford, "A Simple Scoring Weight for Test Items and Its Reliability," *Psychometrika*, VI (1941), 367-74.

the item must apply to the problem despite the vast differences among colleges of pharmacy, regionally, culturally, intellectually, in economic level, and in other factors at which these personal data questions are aimed. For example, an item that emerges as discriminatory by this procedure will predict withdrawal in metropolitan, highly selective colleges of pharmacy as well as in institutions that may not even require high school graduation for admission. An alternative to this procedure would, of course, be the assignment of scoring weights to these personal data items for each region separately or for each institution separately. This might result in finding a much larger number of the items predictive of withdrawal. Not only would such a procedure entail much more statistical work, but also the results would then be applicable only to the institutions involved. It was felt that the present procedures were more feasible and at the same time might yield results that could be applied on a national scale to the prediction of withdrawal-remaining in colleges of pharmacy.

This technique was applied to the 202 alternatives for the 55 personal data items shown in Appendix B. The means of the 32 scoring weights for each of the alternatives were obtained as is shown in Appendix B. It is evident that for most of the questions and their response-alternatives, no discrimination was obtained between remaining and withdrawing students; that is, the mean scoring weight for most of the response alternatives was approximately 4.

Which of the items appeared to be significantly related to withdrawal on a national scale? The following interpretations can be checked by the reader through reference to the mean scoring weights listed opposite each response-alternative in the Personal Data Blank, shown in Appendix B. Question 1, "For how long have you been intending to become a pharmacist?" seems to be thus related. The mean scoring weight for the first alternative is 3.59 (less than 3 months), while that for the second alternative (between 3 and 6 months) is 4.34. Thus, the student who chooses the second alternative is less likely to withdraw from the college of pharmacy.



The second question, "For how long have you worked in a pharmacy?" also seems to be significantly related to withdrawal. Students who answered "have never worked in a pharmacy" or "for less than 1 month" are less likely to remain beyond the first year than are students who choose one of the other three alternatives, namely, who indicate that they have worked in a pharmacy for longer than one month.

Question 3, requiring the student to choose a statement expressing his attitude toward pharmacy as a profession for himself, and Question 8, concerning whether the student has even been registered as an apprentice pharmacist, also seem to throw significant light on the student's chances of withdrawing or remaining after his first year in the college of pharmacy.

Questions 30-55, dealing with participation in community or high school extracurricular activities, also appear in some instances to be valid for predicting withdrawal. In general, students who indicated that they had participated in such activities as band, orchestra, school paper business staff, high school honor society, and Boy or Girl Scouts are more likely to remain in the college of pharmacy. This is especially true of students who had participated as an officer, captain, or leader in such activities.

The major conclusion from the analysis of the Personal Data Blank must be that, although most of the items appear to have no significant relationship to withdrawal from colleges of pharmacy on a nation-wide basis, the technique yields sufficient positive results to indicate that the approach has real promise. The end result of concerted research of this kind could be the construction of a scientifically validated application-for-admission blank for colleges of pharmacy that could be scored objectively in such a way as to enable significant predictions of an applicant's likelihood of remaining in the college of pharmacy beyond the first year.



*The Validity of the Kuder Preference Record for Predicting  
Withdrawal-Remaining in Colleges of Pharmacy*

The preceding portion of this paper reported biserial correlations between various ability and achievement tests of the predictive testing program and withdrawal-remaining in schools of pharmacy. In this section the same data on withdrawal are related by the biserial-correlation technique to the scores on the Kuder Preference Record.<sup>4</sup>

There were eight colleges of pharmacy whose entering freshmen in the fall of 1946 could be investigated as to relationships between interests and withdrawal-remaining. The biserial coefficients of correlation are shown for all eight institutions in summary in Table 6. (The full data for each institution on each test are given in Appendix A, Tables XI-XIX.) It is obvious from inspection that these coefficients differ appreciably from one institution to another for the same interest score. This means that students' withdrawals are not related in the same way for all institutions to the strengths of various interests.

<sup>4</sup>The Kuder Preference Record and the scores resulting from its administration to freshmen entering colleges of pharmacy in the fall of 1946 have been described in *The Abilities and Interests of Pharmacy Freshmen*.

**TABLE 6**  
 Biserial Coefficients of Correlation between  
 Kuder Preference Record Scores and Student Withdrawals

College Number	Mechanical	Computational	Scientific	Persuasive	Artistic	Literary	Musical	Social Service	Clerical
24	-.289	-.239	.053	-.154	.014	-.034	.099	-.091	-.318
21	.083	.070	.169	-.184	.251	.126	-.083	.075	-.219
39	.077	.457	.245	-.231	.118	-.078	.135	-.141	.202
11	.016	.145	.330	.010	-.178	.055	-.197	-.052	.019
25	.002	-.154	.121	.404	-.077	-.161	-.043	-.175	-.111
22	-.015	-.100	-.127	-.158	-.167	-.064	.111	.417	-.064
30	.032	.240	.106	.193	-.046	.238	.489	-.173	.279
29	-.204	.293	-.062	.331	-.462	-.014	.698	.033	-.065

Table 7 shows the frequency distributions of the biserial coefficients listed by schools in Table 6. From the median values of the coefficients as shown in Table 7 it is evident that for the typical college of pharmacy, among the eight studied here, there is practically no relationship between interest test scores and withdrawal-remaining; that is, the median biserial coefficients are all so close to zero that withdrawal cannot to a significant extent be predicted from the interest test scores. The highest median is that for the Scientific interest

TABLE 7

Frequency Distributions of  $r_{bis}$  for Kuder Scales  
and Student Withdrawals

$r_{bi}$	Mech- anical	Com- puta- tional	Scien- tific	Persu- asive	Artistic	Liter- ary	Musi- cal	Social Service	Cler- ical
.600- .699							1		
.500- .599									
.400- .499		1		1			1	1	
.300- .399			1	1					
.200- .299		2	1		1	1			2
.100- .199		1	3	1	1	1	2		
.000- .099	5	1	1	1	1	1	1	2	1
-.100- -.001	1	1	1		2	4	2	2	2
-.200- -.101		1	1	3	2	1	1	3	1
-.300- -.201	2	1		1					1
-.400- -.301									1
-.500- -.401					1				
Median	.0195	.0995	.1328	-.0505	-.0505	-.0255	.0995	-.0505	-.0505

scores; this is .13. Since it is also psychologically meaningful that scientific interest should be positively correlated with survival in colleges of pharmacy, this value provides some slight hope that more significant and practically meaningful correlation would be revealed by more extensive investigation.

That the correlations are no higher is in part due to the limitations of the withdrawal-remaining criterion; these lim-

itations have already been discussed in the preceding section. It would be desirable to follow the students whose interest scores are available until they reach graduation and, if possible, until they have had perhaps five years' opportunity to practice pharmacy. It might then appear that withdrawal-remaining and survival in the practice of pharmacy *are* significantly related to these scores for various kinds of interest.

The authors are for the present unwilling to abandon the hypothesis that prompted this investigation. Strength of interest should make possible significant predictions of withdrawal-remaining in such a profession as pharmacy which, like other specialized occupations, draws upon a unique pattern of interests and preferences as well as upon certain types of abilities and skills. We recommend, therefore, that data concerning withdrawal-remaining be collected concerning the classes that entered in the fall of 1946 from the colleges of pharmacy which administered the Kuder Preference Record at that time; this should be done when those students shall have reached the junior and the senior years. We also recommend that these colleges of pharmacy follow the careers of their alumni to perhaps five years after their graduation so that data can be collected concerning which of the alumni have remained in the practice of pharmacy and which have gone into other occupations. The hypothesis still remains tenable that significant correlations between interest scores and survival in pharmacy will emerge.

## II. Inquiry Concerning Student Personnel Procedures in Colleges of Pharmacy

To what extent and in what way are colleges of pharmacy engaged in student personnel work? If student personnel work is considered to be those educational activities apart from curricular instruction that are primarily concerned with the development of student personalities, this is, indeed, an important question.

To ascertain the way in which colleges of pharmacy throughout the United States were engaging in activity of this kind, the questionnaire reproduced in Appendix C was sent in December 1947 to colleges of pharmacy throughout the nation. Usable returns were received from 32 of the 53 colleges of pharmacy to whom the questionnaire was sent (see Appendix E). Tables XX-XXXII in Appendix D provide the detailed data on which the subsequent discussion is based.

### *Admission Procedures*

The general impression that emerges from an examination of the replies is that admissions, guidance, and counseling procedures are generally of the same pattern in colleges of pharmacy. As far as admission procedures go, the following types of data are used for determining admissions to the typical colleges of pharmacy: rank in high school class; scholastic aptitude or intelligence tests; personal interviews; biographical data; and a health record.

The admissions function is performed by the dean of the college of pharmacy in 62 percent of the institutions, by the registrar in 47 percent, by the director of admissions in 32 percent, and by some other officer in 35 percent. (These percentages total to more than 100 percent because some institutions indicated that more than one officer was responsible for performing the admissions function.)

High school accreditation is typically in the form of state or regional recognition of the high school, these being required by 65 percent and 44 percent of the colleges of pharmacy, respectively.

Of the high school subjects and credits required for admission to colleges of pharmacy, three or four years of English is the most frequent requirement, two years of mathematics is typical, and one or two years of social studies are usually required. The science requirement takes the form of "any laboratory science" in 18 percent of the institutions, "any science" in 24 percent, and a specification of one year in some specific science such as general science, physics, chemistry, or biology in about another 15 percent of the institutions. Apart from these patterns there seems to be wide variation among the colleges of pharmacy as to the high school subjects they require for admission.

In the admission of transfer students, most schools of pharmacy place a restriction of not more than one year of credit transferable from nonpharmacy institutions and a maximum of three years' transfer credit from other colleges of pharmacy. Typically, transfer credits are given only for subjects that are specified in the curriculum of the institution into which transfer is being made. Also in the vast majority of institutions, transfer credits are allowed only in subjects that were passed with at least one grade above the minimum passing grade of the institution in which the credits were earned.

#### *Guidance and Counseling Procedures*

The personal records most frequently kept on students for guidance and counseling purposes are scores on scholastic aptitude tests and on special ability or aptitude tests; health and physical records are kept by a majority of the institutions. Scores on interest tests and rating scales, as well as records of interviews held with students, are also kept in a substantial minority of the institutions. Typically, such records are kept either for the freshmen class only (in a minority of the institutions) or for students in all classes of the college of phar-



macy; that is, records are not kept only for sophomores or juniors. Most of the records are kept in the office of the dean of the college of pharmacy and also to a slightly lesser extent by the office of the registrar or the director of admissions. Instructors typically keep only grade records on their students; testing bureaus and counseling agencies typically keep only test records.

Testing policies for guidance and counseling purposes seem to fall into two separate categories; either no tests at all are used or four or more different tests are used regularly in the guidance of students. The tests used are those usually found in present-day testing and guidance offices—general ability and special ability tests, interest and adjustment inventories, and achievement tests of various kinds.

Under the heading of orientation activities for new students the typical college of pharmacy furnishes group guidance lectures; tours of the campus, pharmacy buildings, and other places; how-to-study courses, lectures, and bulletins; conferences with advisers in making out schedules; and conferences with deans and other administrative officers.

The personnel responsible for student counseling in the typical college of pharmacy include at least some professionally trained, full-time counselors or guidance officers and, almost certainly, some members of the instructional staff who perform guidance functions in helping students with their academic and curricular choices. In only a few of the institutions are part-time professionally trained counseling personnel available.

The requirements placed on students for their use of counseling facilities in the typical college of pharmacy are as follows: all students are required to use counseling facilities in dealing with schedule and curriculum problems; those students who have scholastic difficulties are required to use counseling facilities; and students whose ability or interest in pharmacy is suspect are encouraged to use counseling facilities, but are not required to do so.



In their counseling work, the colleges of pharmacy typically use a wide variety of standardized tests. But a minority (about 30 percent) make no use of tests whatsoever, depending altogether on other sources of student appraisal, such as instructors' grades, observations, interview records, health records, and so forth.

The interview procedure for counseling and guidance is seldom of a specified duration, is usually recorded in written form, and practically always held in a private office.

The special services available to pharmacy students practically always include a part-time employment office. Somewhat less frequently there is an alumni placement office, but many schools of pharmacy say that none is needed during the present great demand for trained pharmacists. Of the other services about which information was requested, psychological clinics were available in slightly more than half the institutions, speech clinics and psychiatric services in slightly less than half, and reading clinics in about one institution out of three.

Tables XX-XXXII in Appendix D give the percentages of the 32 participating institutions who answered each of the questions in the specified way. These tables make possible a more exact understanding of the distribution and character of student personnel services in colleges of pharmacy.

### III. Measuring the Achievement of Pharmacy Seniors

This is a report on the Senior Comprehensive Examinations in pharmacy which were administered in the spring of 1948 throughout the United States. In this report are described the background of the project, the procedures followed in the construction of the examinations, the administration of the examinations, and the significance of the results.

#### *Background of the Project*

The Senior Comprehensive Examinations are a part of the student personnel studies of the Pharmaceutical Survey, which since the spring of 1946 has been carrying on an intensive study of pharmaceutical education and practices in the United States. As one part of this survey a unit study was planned to deal with "Development of special aptitude and achievement tests; comparison of student achievement and progress."

This study, along with others concerning student personnel, was placed under the direction of the present authors. Two previous papers have described the rationale of the predictive and achievement testing program.<sup>1</sup>

Actual work on the achievement examinations was initiated in August 1946 at a conference in Pittsburgh at which committees were appointed under the joint auspices of the Pharmaceutical Survey and the American Association of Colleges of Pharmacy. At this same meeting a tentative schedule for the steps involved in the test construction was drawn up. These steps, to which tentative deadlines for their completion were assigned, are listed in the flow sheet which is reproduced in Appendix F.

<sup>1</sup>"Achievement and Predictive Testing in the Pharmaceutical Survey" and "The Predictive Testing Program of the Pharmaceutical Survey."

The first major step was the formulation of an outline of instructional objectives at the achievement of which the comprehensive examination was to be aimed. A "Memorandum on Achievement Testing," describing the nature of this and subsequent steps, was formulated by the present authors and furnished to each committee member and consultant. (This memorandum is reproduced as Appendix F.) In the fall of 1946 tentative versions of these outlines of instructional objectives began to take shape, to flow into the central office, on to the consultants, back to the central office, and back to the committee members through their chairmen. In January 1947 a meeting of the committee chairmen was held in Chicago, at which the Director of the Survey, the present authors, and representatives of the American Association of Colleges of Pharmacy were also in attendance. The discussions at this meeting clarified various problems in the formulation of objectives and the writing of test items that had arisen as the committee had proceeded with their work.

Work continued during the spring of 1947, and at the time of a second meeting in Chicago, in June 1947, most of the committees had practically completed their work on instructional objectives and were well along with the second major step, the writing of test questions designed to measure the achievement of these objectives. Various letters of instruction from the central office which guided the work of the committees and consultants are reproduced in Appendix G.

The examinations which resulted from this procedure conformed closely in their nature to those originally planned. They were objectively scorable multiple-choice tests covering the various instructional objectives that had been identified in the outlines prepared by the subcommittees and approved by the consultants. Each multiple-choice question had five alternatives, of which only one was the correct answer and the other four represented plausible errors that would appeal, in the judgment of the test authors, to students who did not have the knowledge or other achievement at which the question was aimed. For each instructional objective, the number of questions was adjusted in conformity with the weighting as-

signed to that objective in the outline. Those objectives such as manipulatory skills, which in the judgment of the committee were not amenable to paper-and-pencil, printed testing were, of course, not represented in the examination.

By the early spring of 1948, work on the examinations was so close to completion (1,133 items of the 1,200 projected were in hand) that it was considered possible to attempt the first administration of the examinations to the seniors graduating from colleges of pharmacy in May and June, 1948.

### *The Administration of the Examination*

As soon as it became evident that the examination could be ready in time for administration to spring graduating classes, the following letter was sent by Dr. Elliott:

March 22, 1948

To the Deans of Colleges and Schools of Pharmacy:

As you will recall from "Achievement and Predictive Testing in the Pharmaceutical Survey" (*Am. J. Phar. Educ.*, Jan. 1947, pp. 43-53) a comprehensive examination for seniors is an integral part of the Student Personnel Studies of the Survey. Four subcommittees of the AACP have been at work for nearly two years on the construction of this examination.

The labors of these subcommittees in cooperation with the staff of the Student Personnel Studies have now made it possible to plan the administration of the Comprehensive Senior Examinations in Pharmacy this spring in selected institutions.

The examinations will cover pharmaceutical chemistry, pharmacology, pharmacognosy, and pharmacy. They require approximately twelve hours testing time and supervision by at least one responsible staff member in each institution. The Comprehensive Senior Examinations in Pharmacy will be provided without cost to participating institutions. They will be centrally scored, and the results for your seniors will be sent to you some weeks after the examinations.

The dates of the examination should obviously come as near the end of your semester or quarter as possible. Since it will not be possible to return the results to you in time for use in grading seniors, and in order to insure adequate motivation of the students, they should

be told that their scores will be sent to the Secretary of the National Association of Boards of Pharmacy.

To enable appropriate planning by the staff of the Student Personnel Studies, you are requested to fill out and return the attached form before April 5 to H. H. Remmers, Student Personnel Studies, Purdue University, Lafayette, Indiana. (A duplicate form is provided which may be retained in your own files.)

Very sincerely yours,

Edward C. Elliott  
Director

The response of the colleges of pharmacy to this invitation was gratifying, especially in view of the relatively late date at which it was necessary to issue these invitations. The following colleges of pharmacy accepted the invitation and administered at least one of the examinations to all of their graduating seniors.

Albany College of Pharmacy	University of Colorado
Brooklyn College of Pharmacy	University of Connecticut
Cincinnati College of Pharmacy	University of Illinois
George Washington University	University of Kansas City
Howard University	University of Maryland
Loyola University	University of Mississippi
Medical College of South Carolina	University of North Carolina
Medical College of Virginia	University of Pittsburgh
Ohio State University	University of Texas
Purdue University	University of Washington
St. John's University	University of Wisconsin
St. Louis College of Pharmacy	Xavier University
University of Buffalo	

The dates of administration of the examinations ranged from May 3 to July 13, 1948. In all, the number of students tested ranged from 635 for the Pharmaceutical Chemistry and Pharmacology Examinations to 718 for the Pharmacy Examination. The variations of the number of students who took the four examinations were due to administrative difficulties, of one sort or another, that prevented individual colleges from using one or more of the tests. Of the 25 colleges of pharmacy that gave at least one of the examinations, 21

gave all four examinations, 3 gave three, and 1 gave only one. It is estimated that approximately 50 percent of all the seniors graduating from colleges of pharmacy in the spring of 1948 participated in this testing program. The representativeness of the results and of the conclusions drawn must be judged in the light of this percentage, as well as of the geographical distribution and other characteristics of the participating institutions.

Administration of the examination was according to a standard set of directions, reproduced in Appendix H, to be followed by all institutions. Since there were no intra-examination time limits, and since what was judged to be an ample time limit of three hours was allowed for each examination, it is highly likely that the administration of the examination was adequately standardized and that no irrelevant factors of administration interfered with the students' demonstration of their achievement on the examinations.

#### *Interpretation of the Results*

As soon as the examinations had been given, the test booklets and answer sheets were returned to the central office, at Purdue University. The answer sheets were scored by machine, each score being the number of right answers. Before scoring, the answer sheets were, in accordance with approved practice, inspected for double answers and for stray pencil marks that would tend to reduce accuracy of scoring.

**The Total Group:** Frequency distributions of the total scores on the four examinations are shown along with percentile norms and other descriptive statistical measures in Tables 8, 9, 10, and 11. It is evident at once from these distributions that great individual differences in achievement characterize the seniors graduating from colleges of pharmacy in the spring of 1948. Such wide individual differences in achievement are, of course, only to be expected in the light of available evidence concerning individual differences in scholastic ability.<sup>2</sup>

<sup>2</sup> *The Abilities and Interests of Pharmacy Freshmen.*



TABLE 8

Raw Scores and Their Percentile Ranks on the Senior  
Comprehensive Examination in Pharmacology, Spring 1948

Distribution of Scores		Percentile Ranks* Corresponding to Raw Scores					
Interval	Frequency	Score	Per- centile	Score	Per- centile	Score	Per- centile
132-138	3	130-138	100	100	77	82	32
125-131	6	124-129	99	99	75	81	30
118-124	17	122-123	98	98	74	80	27
111-117	20	120-121	97	97	72	79	24
104-110	61	117-119	96	96	69	78	22
97-103	76	114-116	95	95	67	77	19
90-96	128	112-113	94	94	64	76	17
83-89	116	111	93	93	61	75	15
76-82	106	110	92	92	58	74	13
69-75	74	109	91	91	56	73	12
62-68	19	108	90	90	53	72	10
55-61	7	107	88	89	50	71	8
48-54	2	106	86	88	48	70	7
Total	635	105	85	87	45	69	5
		104	84	86	42	66-68	3
		103	82	85	40	64-65	2
		102	81	84	37	59-63	1
		101	79	83	34	0-58	0
Mean**		87.70					
S. D.***		14.29					

\*A "percentile rank" defines the score below which a specified percent of all raw scores fall. For example, 93 percent of all seniors on this test achieved a score of 111 or less, so that 7 percent (100-93) achieved a score of 11 or more. Tables 9, 10, and 11 are read in a similar manner.

\*\*The "mean" is the arithmetic average.

\*\*\*The "standard deviation" is a measure of variability or spread, of the scores.

If the assumption is accepted that these examinations were tapping significant and professionally relevant areas of achievement in training, the obvious conclusion from these distributions must be that colleges of pharmacy, like educational institutions in general, yield no highly standardized product. Graduation from a college of pharmacy may be interpreted to signify at least some minimum achievement of the objectives



of pharmaceutical education; but any further assumption that one graduate knows as much as any other graduate is not justified.

TABLE 9

Raw Scores and Their Percentile Ranks on the Senior Comprehensive Examination in Pharmacognosy, Spring 1948

Distribution of Scores		Percentile Ranks Corresponding to Raw Scores					
Interval	Frequency	Score	Per- centile	Score	Per- centile	Score	Per- centile
190-200	4	197-200	100	142	71	115	28
179-189	10	184-196	99	141	69	114	26
168-178	22	178-183	98	140	68	113	25
157-167	50	174-177	97	139	67	112	23
146-156	88	171-173	96	138	66	111	22
135-145	102	168-170	95	137	64	110	21
124-134	146	166-167	94	136	63	109	20
113-123	115	164-165	93	135	61	108	19
102-112	95	163	92	134	60	107	17
91-101	52	161-162	91	133	58	106	16
80-90	18	159-160	90	132	56	105	15
69-79	6	158	89	131	55	104	14
58-68		157	88	130	52	103	13
47-57	1	156	87	129	50	102	12
Total	709	155	86	128	49	101	10
		154	85	127	47	98-99	9
		153	84	126	45	97	8
		152	82	125	43	95-96	7
		151	81	124	41	93-94	6
		150	80	123	39	92	5
		149	79	122	38	89-91	4
		148	78	121	36	85-88	3
		147	77	120	35	83-84	2
		146	75	119	34	82	1
		145	74	118	32	0-81	0
		144	73	117	31		
		143	72	116	29		
Mean	129.31						
S.D.	23.00						

TABLE 10

Raw Scores and Their Percentile Ranks on the Senior Comprehensive Examination in Pharmaceutical Chemistry, Spring 1948

Distribution of Scores		Percentile Ranks Corresponding to Raw Scores							
Interval	Frequency	Score	Per- centile	Score	Per- centile	Score	Per- centile	Score	Per- centile
245-255	2	240-255	100	172-173	77	149	52	126	25
234-244	4	228-239	99	171	76	148	51	125	23
223-233	5	217-227	98	170	75	147	50	124	22
212-222	7	210-216	97	169	74	146	48	123	21
201-211	19	207-209	96	168	73	145	47	122	20
190-200	30	203-206	95	167	72	144	46	121	19
179-189	45	200-202	94	166	71	143	45	120	18
168-178	58	198-199	93	165	70	142	43	119	17
157-167	75	196-197	92	164	69	141	42	118	16
146-156	84	194-195	91	163	68	140	41	117	15
135-145	85	192-193	90	162	67	139	40	116	13
124-134	82	190-191	89	161	66	138	39	115	12
113-123	74	188-189	88	160	65	137	38	114	11
102-112	37	186-187	87	159	63	136	36	112-113	10
91-101	18	185	86	158	62	135	35	111	9
80-90	9	183-184	85	157	61	134	34	109-110	8
69-79	1	182	84	156	60	133	33	107-108	7
Total	635	180-181	83	155	59	132	32	106	6
		179	82	154	58	131	31	104-105	5
		177-178	81	153	57	130	29	100-103	4
		176	80	152	55	129	28	94-99	3
		175	79	151	54	128	27	89-93	2
		174	78	150	53	127	26	83-88	1
								0-82	0

Mean 149.23

S.D. 31.05

TABLE 11

Raw Scores and Their Percentile Ranks on the Senior Comprehensive Examination in Pharmacy, Spring 1948

Distribution of Scores		Percentile Ranks Corresponding to Raw Scores					
Interval	Frequency	Score	Percentile	Score	Percentile	Score	Percentile
192-200	1	179 up	100	144	71	119	27
183-191		173-178	99	143	69	118	26
174-182	9	171-172	98	142	67	117	25
165-173	30	170	97	141	66	116	24
156-164	53	168-169	96	140	64	115	22
147-155	83	166-167	95	139	63	114	21
138-146	112	164-165	94	138	61	113	20
129-137	112	163	93	137	59	112	18
120-128	114	162	92	136	57	111	17
111-119	83	161	91	135	56	110	16
102-110	60	159-160	90	134	54	109	15
93-101	31	158	89	133	52	108	14
84-92	16	157	88	132	50	107	13
75-83	9	156	87	131	49	106	12
66-74	3	155	86	130	47	105	11
57-65	1	154	85	129	45	104	10
48-56		153	84	128	43	103	9
39-47		152	82	127	42	102	8
30-38	1	151	81	126	40	99-101	7
Total	718	150	80	125	38	97-98	6
		149	78	124	36	94-96	5
		148	77	123	34	92-93	4
		147	76	122	33	87-91	3
		146	74	121	31	80-86	2
		145	73	120	29	70-79	1
						0-69	0

Mean 131.12  
S.D. 21.74

**Institutional Differences:** The institutional differences in the achievement of graduating seniors are evident in the rosters of means and other descriptive statistics given in Tables 12, 13, 14, and 15. (The numbers assigned to the colleges are the same as those used in previous reports of the student personnel studies.) Here also the differences are striking.

It is conceivable that these differences in average achievement among the institutions could have arisen merely through

TABLE 12

Descriptive Statistics of Scores on the  
Senior Comprehensive Examination in  
Pharmacology, by Colleges

College Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
2.....	68	92.22	14.10	84.90	91.85	95.95
4.....	64	85.75	13.26	76.30	84.50	96.70
7.....	18	87.28	13.28	78.25	87.85	95.35
9.....	9	106.44	13.83		107.00	
10.....	36	92.42	15.47	81.50	91.50	102.50
11.....	22	97.00	13.90	90.13	99.50	105.75
12.....	23	105.04	13.73	98.25	105.75	112.65
14.....	30	91.00	13.38	82.00	89.50	101.00
17.....	56	87.71	11.59	78.40	87.00	94.50
21.....	29	83.38	11.21	75.40	82.00	91.70
24.....	27	92.19	10.14	85.75	92.00	99.80
25.....	38	89.89	12.60	80.15	89.50	98.25
27.....	35	100.00	11.96	91.85	100.75	106.60
32.....	32	90.75	12.69	82.85	89.50	94.50
33.....	61	83.07	12.35	75.65	82.40	89.40
38.....	11	105.64	12.45	96.40	102.00	117.85
39.....	32	91.84	11.42	83.50	91.40	100.75
40.....	10	85.50	9.76	78.25	82.85	92.00
41.....	11	82.91	13.28	73.90	78.65	95.75
42.....	8	73.25	7.81		72.00	
47.....	8	92.00	10.90		92.85	
52.....	37	93.22	10.09	86.75	92.45	97.90

F = 6.08; p is less than .01.

chance fluctuations in random sampling. That is, the differences might not be so large (in relation to general variability in the scores) that they could not disappear or even reverse themselves if similar samples were drawn in the same way from the same institutions. To test this possibility, the differences among the institutions have been tested for statistical significance by means of analysis of variance. The results of this analysis are shown in the note at the foot of Tables 12,

TABLE 13

Descriptive Statistics of Scores on the  
Senior Comprehensive Examination in  
Pharmacognosy, by Colleges

College Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
2	68	131.56	30.84	104.50	129.50	157.83
4	77	145.77	20.67	131.55	146.00	159.35
5	4	155.75	19.80		154.50	
7	18	127.28	14.19	118.25	126.15	135.75
9	9	132.56	18.63		133.65	
10	43	133.40	20.24	117.94	128.25	149.81
11	22	138.82	13.61	130.75	137.83	145.75
12	23	133.30	16.30	125.13	130.13	147.63
14	37	121.19	18.07	107.40	119.00	128.60
17	56	141.64	18.99	128.25	142.50	153.95
21	29	121.31	19.37	105.75	122.00	130.25
24	27	122.93	12.48	115.05	122.00	133.25
25	38	120.55	18.24	105.75	122.00	132.65
27	35	142.86	19.14	129.10	142.00	154.80
32	32	121.69	17.54	109.50	118.50	135.50
33	62	115.79	17.29	103.66	115.20	127.90
39	31	133.45	14.93	121.38	137.00	143.97
40	10	134.50	21.24	125.75	134.50	150.75
41	11	133.36	18.35	123.25	130.75	145.75
42	8	97.63	18.78		89.50	
50	46	113.63	21.01	105.00	115.75	128.90
52	37	135.24	17.52	122.55	132.00	147.65
53	68	130.82	20.92	113.50	133.25	144.50

F = 7.48; p is less than .01.

13, 14, and 15. Here are given the "F" values (ratios of variance among colleges to that within colleges) and the corresponding "p" values (probability that obtained differences could have arisen by chance). In general, the conclusion to be drawn is that the differences among the institutions are statistically significant (not ascribable to chance) and that it is justifiable to infer real differences in average achievement among the various institutions.

TABLE 14

Descriptive Statistics of Scores on the  
Senior Comprehensive Examination in  
Pharmaceutical Chemistry, by Colleges

College Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
2	68	150.90	30.28	128.50	144.50	169.50
4	76	175.49	32.28	160.35	177.35	195.20
5	4	160.75	19.16		162.00	
7	19	158.58	26.21	145.45	152.25	168.25
9	9	157.56	22.29		157.00	
10	46	137.54	24.54	119.00	135.35	147.00
11	21	151.05	21.91	135.13	153.17	166.38
12	23	170.26	31.61	132.40	187.00	196.60
14	38	133.97	23.04	120.00	132.00	145.35
17	56	169.23	31.28	147.00	167.00	189.50
21	29	139.59	21.03	121.60	142.00	160.45
23	30	138.67	35.48	110.35	137.00	157.00
24	27	148.85	21.69	135.75	149.00	163.25
25	38	136.47	26.08	120.15	127.85	153.65
27	35	169.57	26.79	148.25	175.15	185.75
32	32	143.56	22.13	126.15	139.50	156.15
33	61	125.85	26.53	104.90	124.00	139.30
38	11	146.55	25.62	128.25	137.00	157.85
39	32	139.97	26.34	118.80	132.00	157.00
40	10	128.00	17.00	118.25	122.85	138.25
41	11	142.91	29.91	123.25	148.25	160.75
42	8	99.50	15.21		99.50	
47	8	129.50	26.10		132.00	
50	46	156.02	24.84	138.65	152.50	177.00
52	37	160.65	25.27	146.05	157.65	171.40
53	66	133.74	23.60	115.75	130.50	146.60

F = 11.66; p is less than .01.

**TABLE 15**

Descriptive Statistics of Scores on the Senior Comprehensive Examination in Pharmacy, by Colleges

College Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
2	68	130.01	15.51	120.75	131.40	139.50
4	74	143.62	22.72	129.10	148.65	158.10
5	4	119.50	25.62		109.50	
7	18	128.67	15.72	118.25	126.15	137.00
9	9	135.89	19.83		140.75	
10	42	120.81	16.50	110.15	122.85	132.00
11	21	139.86	23.63	130.13	142.00	158.88
12	23	148.74	16.79	143.90	153.90	158.90
14	35	117.29	19.85	105.15	113.00	130.75
17	56	129.41	14.94	119.50	129.05	139.50
21	29	130.45	15.09	118.05	128.25	139.25
24	27	137.00	16.83	127.25	137.00	145.75
25	38	128.97	17.83	115.35	127.35	142.00
27	35	153.29	20.37	140.75	153.45	163.90
32	32	132.94	13.49	122.85	134.50	143.25
33	63	124.94	19.49	115.15	124.80	134.75
38	11	126.09	25.12	103.25	123.25	142.85
39	32	129.19	19.60	117.00	126.15	144.50
40	10	124.00	15.68	117.00	122.85	135.75
41	11	147.91	12.03	141.25	144.00	157.65
42	8	90.13	21.06		101.15	
47	8	140.13	15.80		137.00	
50	48	145.33	23.68	134.50	148.50	162.00
52	37	142.81	18.03	133.55	140.75	154.19
53	63	118.19	21.89	105.75	117.40	138.25

F = 26.12; p is less than .01.



**District Differences:** When the students and colleges are grouped according to the geographical districts of the United States in which they are located, differences in average score are again apparent. Tables 16, 17, 18, and 19 show these descriptive statistics for the seven districts set up by the American Association of Colleges of Pharmacy. Since some of the dis-

**TABLE 16**

Descriptive Statistics of Scores on the Senior Comprehensive Examination in Pharmacology, by Districts

District Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
I	27	92.19	10.14	85.75	92.00	99.80
II	225	91.00	15.27	80.04	91.02	101.25
III	80	90.13	11.97	81.16	89.88	98.88
IV	233	91.76	14.17	81.81	91.01	101.19
V	(No colleges from this district participated)					
VI	98	83.89	12.15	75.82	83.03	91.46
VII	36	92.42	15.47	81.50	91.50	102.50
VIII	18	87.28	13.28	78.25	87.85	95.35

F = 4.61; p is less than .01.

**TABLE 17**

Descriptive Statistics of Scores on the Senior Comprehensive Examination in Pharmacognosy, by Districts

District Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
I	27	122.93	12.48	115.05	122.00	133.25
II	225	134.38	22.30	121.15	133.80	148.91
III	79	127.38	18.65	112.25	128.04	141.32
IV	240	131.92	25.23	113.79	130.61	150.75
V	(No colleges from this district participated)					
VI	159	123.23	20.47	107.42	122.18	137.52
VII	43	133.40	20.24	117.94	128.25	149.81
VIII	18	127.28	14.19	118.25	126.15	135.75

F = 9.75; p is less than .01.

tricts are represented by only one college out of the several within that region, our interpretations of the regional grouping of the scores must be cautious. It is evident, however, in view of the regional differences and in view of the fact that analyses of variance reveal that these differences are statistically significant (all "p" values are less than .01), that there are reli-

TABLE 18

Descriptive Statistics of Scores on the Senior Comprehensive Examination in Pharmaceutical Chemistry, by Districts

District Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
I.....	27	148.85	21.69	135.75	149.00	163.25
II.....	264	160.26	31.72	138.14	160.17	181.86
III.....	80	136.81	25.50	119.05	128.25	153.50
IV.....	241	152.68	31.94	128.52	148.10	175.49
V.....	(No colleges from this district participated)					
VI.....	164	131.63	24.96	114.05	129.50	147.17
VII.....	46	137.54	24.54	119.00	135.35	147.00
VIII.....	19	158.58	26.21	145.45	152.25	168.25

F = 20.49; p is less than .01.

TABLE 19

Descriptive Statistics of Scores on the Senior Comprehensive Examination in Pharmacy, by Districts

District Number	No. of Students	Mean	Standard Deviation	Q <sub>1</sub>	Median	Q <sub>3</sub>
I.....	27	137.00	16.83	127.25	137.00	145.75
II.....	234	143.09	21.93	131.85	145.82	158.16
III.....	80	128.44	18.39	116.38	126.50	141.50
IV.....	238	130.30	21.23	115.53	130.29	144.88
V.....	(No colleges from this district participated)					
VI.....	163	124.06	20.45	112.42	123.63	137.92
VII.....	42	120.81	16.50	110.15	122.85	132.00
VIII.....	18	128.94	16.51	118.25	126.15	137.00

F = 42.10; p is less than .01.

able differences among the regions in the average achievement of their graduating seniors in pharmacy. It is also significant that the rank orders of the regions are very similar for each of the four examinations. That is, regions which rank high in average achievement on one examination also rank high on the others; likewise, regions that rank low on one also rank low on the others. Thus, the four examinations tended to rank the various geographical regions in average achievement in the same way.

**Sex Differences:** How do men and women graduating seniors in pharmacy compare? Table 20 shows the means and the other descriptive statistics of the scores on the four examinations for men and women. Men achieved higher mean scores than women on all four of the examinations. When tests of the statistical significance of the differences are made on this basis, the probabilities that similar differences could have arisen

TABLE 20

### Descriptive Statistics of Scores on the Senior Comprehensive Examinations, by Sex

Examination	Sex	No. of Students	Mean	Standard Deviation	$Q_1$	Median	$Q_3$
Pharmacology	M	577	90.67	14.44	80.58	90.10	100.31
	F	140	88.28	13.05	78.00	88.50	101.58
Critical ratio equals 1.90; p is less than .06							
Pharmacognosy	M	642	131.12	22.69	115.82	130.28	146.49
	F	149	125.62	20.91	109.60	123.67	139.29
Critical ratio equals 2.85; p is less than .01							
Pharmaceutical Chemistry	M	683	150.78	31.63	126.67	147.75	172.32
	F	158	139.34	28.09	118.82	134.50	158.11
Critical ratio equals 4.50; p is less than .01							
Pharmacy	M	651	133.32	21.72	119.00	134.40	149.03
	F	151	127.73	22.21	113.05	126.75	142.07
Critical ratio equals 2.80; p is less than .01							

en solely through chance fluctuation in random sampling can be estimated. These probabilities are listed under each pair of means in Table 20; they indicate that the sex differences on all examinations were statistically significant. Thus, it is extremely likely that if further samples of men and women were chosen in the same way, the differences in favor of the men would recur. The average achievement of male graduating seniors in pharmacy is superior to that of the female seniors. This average superiority of the men should not, of course, obscure the fact that there is great overlapping between the distributions of scores of the two sexes so that many of the female seniors are in fact superior to many of the men.

**The Reliability of the Examinations:** The reliability of a test is an estimate of the consistency with which it would yield the same results if additional measurements were made with it. Of the many methods for estimating the reliability of a test, two have been applied here: the corrected split-half method and the Kuder-Richardson Footrule method, the latter of which usually, when compared with other methods, yields an underestimate of reliability. The higher the coefficients of reliability, the more accurately the test is measuring whatever it does measure. *Reliability* should, of course, be distinguished from the *validity* of a test, which is the degree to which the test measures what it is intended to measure. Reliability is necessary but not sufficient for validity, which must be determined in terms of the specific purpose of a test.

Table 21 shows the reliability coefficients estimated by the two methods along with relevant descriptive statistics. It is evident that by both methods the Pharmaceutical Chemistry Examination was the most reliable, its coefficients being .935 and .926 for the corrected split-half and the Kuder-Richardson methods respectively. The Pharmacology Examination was the least reliable, its estimates being .849 and .788.

TABLE 21

Reliability Coefficients of the  
Senior Comprehensive Examinations

Examination	No. of Items	Number of Students in Split-half Reliability Estimate	Corrected Split-half Reliability Coefficient	Mean, Total Group	Standard Deviation, Total Group	Kuder- Richardson Footrule Reliability Coefficient
Pharmacology	174	300	.849	89.30	14.18	.788
Pharmacognosy	300	300	.866	128.77	23.21	.867
Pharmaceutical Chemistry	300	307	.935	148.17	31.25	.926
Pharmacy	250	302	.897	131.12	21.74	.872

The interpretation to be made of these reliability coefficients is that the examinations in their present form have, except for the Pharmaceutical Chemistry Examination, only fair reliability. The reliabilities should be improved by further refinement of the examinations, especially in terms of the evidence concerning individual questions yielded by the item analysis. If questions are revised to be more discriminating and to have less deadwood in the form of nondiscriminating response alternatives and complete questions, it is safe to predict that the reliability of all these examinations can be substantially improved.

It should not be overlooked that for four or more years the colleges of pharmacy have been trying to make each of the graduating classes as homogeneous as possible in their pharmaceutical ability. The problems of measurement involved in discriminating among graduates are thereby, of course, made more difficult. These efforts—via dropouts and instruction—to have seniors highly similar in achievement are, however, not highly successful, as the distributions of test scores show. Hence, the reliabilities of the achievement examinations can still be made satisfactorily high without making these examinations any longer. As already noted, removal of deadwood

and revision of alternatives and items will improve not only reliability but also validity of the examinations.

In one or two instances doubt was expressed by those who administered the examinations as to the seriousness with which their students took the examinations. If there was lack of motivation, this would also tend to reduce reliability. The reliability will be increased, within limits, as motivation of the examinees increases.

**Intercorrelations of the Examinations:** To what extent are the scores on each examination related to those on the other examinations? The answer to this question will throw light on the degree to which the achievements measured by the Senior Comprehensive Examinations are specific or general. The intercorrelations among the examinations are shown in Table 22. These range from .482 for the correlation between the Pharmacy and Pharmacology Examinations to .665 for that between the Pharmacy and Pharmaceutical Chemistry Examinations. It is evident from the six coefficients considered together that the achievements and abilities measured by the four examinations are substantially interrelated so that students who rank high on one of the examinations also tend to rank high on the others. But the correlations are not so high as to permit any safe inference concerning a student's over-all achievement from his score on any single examination. That is, although the achievements are substantially interre-

**TABLE 22**

Intercorrelations of the Senior Comprehensive Examinations  
(N=approximately 700)

Examination	Mean	Standard Deviation	Phar- macy	Pharm. Chem.	Pharma- cognosy	Pharma- cology
Pharmacy .....	131.12	21.74		.665	.527	.482
Pharmaceutical Chemistry .....	148.35	31.24	.665		.645	.499
Pharmacognosy .....	128.77	23.21	.527	.645		.600
Pharmacology .....	87.70	14.29	.482	.499	.600	



lated, we cannot substitute the information from one of the examinations for that from all of them. Not only are the examinations too independent on the face of them, in terms of the subject matters and curricular materials at which they are aimed, but statistically they are also sufficiently independent to justify the use of all four of the examinations.

**Item Analysis:** Item-analysis techniques are used to ascertain the discriminatory and difficulty values of individual examination questions. The discriminatory value of an examination question is its ability to distinguish between good and poor students. Good students are defined as those who receive high scores on the given examination, while poor students are those who receive low scores. The difficulty of a question tells how often students chose a given answer or alternative response; the more frequently it was chosen, the higher the difficulty index. And, if the response under consideration is the correct one, the higher the difficulty index, the *easier* the question.

The technique of item analysis applied to the Senior Comprehensive Examinations in Pharmacy was an adaptation (by omitting the correction for chance success) of that developed by Davis.<sup>2</sup>

For each examination, the answer sheets of the students whose scores put them in the highest 27 percent of all the students were selected for the item analysis; similarly the answer sheets of the students scoring in the lowest 27 percent were selected. For each response alternative to each question, two percentages were obtained: (1) the percentage of students in the highest 27 percent group that chose the alternative, and (2) the similar percentage of students in the lowest 27 percent group. These percentages were entered in Davis' table to obtain the discrimination and difficulty indexes.

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<sup>2</sup> Fredrick B. Davis, *Item-Analysis Data: Their Computation, Interpretation and Use in Test Construction*, Harvard Education Papers, No. 2 (Cambridge, Mass.: Graduate School of Education, Harvard University, 1946).



The discrimination index is a function of the difference between the percentages in the upper and lower 27 per cent groups who chose a given response alternative. If the response alternative under consideration is the correct one, this index should be a positive number; if the response alternative is one of the three or four incorrect ones, the discrimination index should be a negative number. The greater the difference between the percentages in the upper and lower 27 percent groups, the greater the absolute value of the discrimination index.\*

The difficulty index is a function of the average percentage of the upper and lower 27 percent groups who chose the given response alternative. This average percentage is converted by means of the normal probability integral into equal units along a scale ranging from 0 to 100.

Shown below are the item-analysis data (discrimination and difficulty indexes) for the response alternatives of two sample questions, the first of which had a high discrimination index for the correct answer, and the second of which had a negative discrimination index for the correct answer (the correct answer is starred):

Disc.	Diff.	11. To what does temporary hard water owe its hardness?
-28	18	11-A Sodium and potassium chlorides.
-18	17	11-B Potassium and sodium sulfates.
-10	44	11-C Magnesium and calcium sulfates.
22	48	*11-D Magnesium and calcium bicarbonates.
- 7	5	11-E Ferric sulfate.
Disc.	Diff.	74. 1.0000 gram of a trivalent element unites with 0.3442 gram of oxygen. The atomic weight of the element is?
- 2	28	74-A 27.00.
-21	38	74-B 34.42.
-11	19	*74-C 69.72.
15	28	74-D 139.16.
- 7	5	74-E 204.39.

\*The discrimination index yielded by Davis' table is the correlation coefficient between the response alternative and the total test score converted (by means of Fisher's z-transformation) into a number ranging from 0 to 100. Thus, a correlation coefficient of .30 is equivalent to a discrimination index of 18.5. A correlation coefficient of .20 is equivalent to a discrimination index of 12.

In item 11 the correct answer is 11-D, and it has a discrimination index of 22. The incorrect responses all have negative discrimination indexes indicating that they were chosen more often by students in the lower 27 percent group than by those in the upper 27 percent group. The difficulty index of the correct response (11-D) is 48, indicating that approximately half of the students chose this answer. The item-analysis data here indicate that the item functioned properly in discriminating between good and poor students, that all the incorrect response alternatives discriminated effectively, and that the difficulty of the question was neither too high nor too low.

**TABLE 23**

Distributions of Discrimination  
Indexes for the Senior Comprehensive  
Examinations in Pharmacy

Discriminatory Index	Pharmacy	Pharmaceutical Chemistry	Pharm- acognosy	Pharm- acology
60-64		1		
55-59		1		
50-54		4		
45-49	2	3		
40-44	2	4	4	
35-39	2	15	2	1
30-34	11	27	8	1
25-29	35	48	27	19
20-24	37	56	39	31
15-19	53	55	58	41
10-14	43	38	72	40
5- 9	33	22	35	24
0- 4	24	16	31	12
(- 1)-(- 5)	2	5	15	4
(- 6)-(-10)	1	1	7	1
(-11)-(-15)	3	3	1	
(-16)-(-20)	2	1	1	
(-21)-(-25)	1			
Total No.	251	300	300	174
Mean	15.73	19.94	13.70	15.02
S.D.	10.62	11.62	10.05	7.93

The information from the analysis of item 74 indicates that something is wrong with this question. More students in the lower 27 percent group chose the correct answer 74-C than did students in the upper 27 percent group; the discrimination index for the correct answer is, therefore, a negative number (-11). Answer 74-D has a positive discrimination index, although it was considered by the authors of the test to be incorrect. Furthermore, response 74-A has a discrimination index so close to zero that it did little discriminating either positively or negatively; as an incorrect response alternative it should have had a negative discrimination index. This

**TABLE 24**  
Distributions of Difficulty Indexes  
for the Senior Comprehensive Examinations  
in Pharmacy

Difficulty Index	Pharmacy	Pharmaceutical Chemistry	Pharmacognosy	Pharmacology
90-94		1		
85-89	1	2		
80-84	2	2	3	1
75-79	9	10	3	1
70-74	8	6	4	5
65-69	20	24	5	6
60-64	26	26	24	15
55-59	34	20	35	21
50-54	39	33	31	22
45-44	33	64	48	20
40-44	23	41	33	24
35-39	26	30	28	22
30-34	12	19	44	14
25-29	9	12	22	13
20-24	3	6	11	3
15-19	2	4	6	4
10-14	2		1	3
5- 9			1	
0- 4			1	
Total No.	249	300	300	174
Mean	50.88	48.94	44.13	50.53
S.D.	13.77	13.89	13.85	13.90

information should be used by the authors of the examination in revising this question. Regardless of the face value of the question or of how acutely its authors considered it to be tapping student achievement, it did not serve its purpose if it can be assumed (as it must) that the examination as a whole was serving its purpose.

Tables 23 and 24 show the distributions of discrimination and difficulty indexes, respectively, for the four examinations, along with the means and standard deviations of these distributions.

These indexes are those for the *correct* answers to each of the questions in each examination. It is evident that all of the examinations had some questions whose correct answers had negative discrimination indexes and still more questions whose discriminatory value was so low (below 10) that some attempt to improve them should be made.

The distribution of difficulty indexes shown in Table 24 indicates that the average level of difficulty of all of the examinations was appropriate (about 50) for these students. What should be the distribution of difficulty indexes in the ideal test? This depends upon the kind of discrimination for which the test is intended, the degree to which the items of the test are intercorrelated, and other considerations. On the present examinations, whose items are probably positively correlated to a small extent and which are intended to have maximum discriminating power throughout the entire range of test scores, the distribution of item difficulty should have a large proportion clustering about the 50 percent difficulty level. The distributions in Table 24 show that this objective was attained to a high degree; the tests need practically no improvement as far as their level of difficulty is concerned.

#### *The Future of the Senior Comprehensive Examinations*

As originally conceived, the Senior Comprehensive Examinations in Pharmacy are to serve primarily as a criterion of

success in pharmacy training against which to validate the predictive tests administered in the fall of 1946 and 1947 to entering freshmen. Under this program, the examinations should be refined and readministered in 1949, then again revised and administered in 1950 to the graduating seniors who took the predictive tests as entering freshmen in the fall of 1946.

It will then be possible through correlational analyses to determine the validity of the predictive tests against a criterion of success more reliable and valid than any other available. Research on more valid predictors can then proceed in the light of the studies of the validity of the present predictive battery. Continuous research on the improvement of both predictive and criterion measures should increase the predictability of success and eventuate in a highly improved basis for student selection, guidance, and placement in colleges of pharmacy.

Apart from their usefulness as a criterion for the predictive battery the Senior Comprehensive Examinations should be refined and readministered on a continuing basis because of their value as measures of achievement in pharmacy. These measures should, as rapidly as is feasible, incorporate the findings of other studies of the Pharmaceutical Survey.<sup>3</sup>

The Senior Comprehensive Examinations, if so revised and refined, can eventually serve as a nationally meaningful yardstick of achievement in pharmaceutical training. They may eventually serve to supplement, if not to replace, the state board examinations whose shortcomings are detailed in the next section.

Further research on the Senior Comprehensive Examinations should give special attention to the possibility that highly significant aspects of achievement in pharmacy have been neglected through restricting the examination to short-answer, paper-and-pencil testing. Manipulatory skills involved in fill-

<sup>3</sup>See "Achievement and Predictive Testing in the Pharmaceutical Survey," pp. 46-47.

ing prescriptions, in performing laboratory analyses, and in other tasks of the pharmacist, have obviously been omitted from the present set of examinations. Similarly, it is possible that certain habits of accuracy have been insufficiently or improperly tapped by the present tests. Furthermore, it is possible that parts of these examinations have unduly stressed rote memorization, unimportant details, or obsolete concepts at the expense of more worth-while material. All these possibilities need investigation so that necessary steps to eliminate them can be taken in the next form of these examinations.

The following recommendations are, therefore, made:

1. Copies of the present examinations should be submitted along with the item-analysis data concerning them to the respective subcommittees so that necessary revisions in specific items can be made in the light of item-analysis data.

2. If possible, revision of the examinations should be completed during the fall of 1948 so that the revised editions of them can be administered to the relatively small group of seniors who will be graduating at midyear of 1949. Administration to this small group should provide a basis for additional revision of the examinations to be given in the spring of 1949.

3. Considerations should be given to the desirability of appointing fresh committees for each of the four subject-matter areas or of supplementing the present committee members with additional new members. Such new committee members could insure more varied and therefore probably more adequate points of view concerning the subjects of the examinations. Selection of new members should be made with a view to interest in, and other qualifications for, this type of test construction.

4. A special committee should be appointed to consider ways of developing performance, or "practical," tests of laboratory and other manipulative achievements that can be ad-



ministered and scored in a reliable and valid fashion. The assistance of a specialist in measurement and evaluation will be particularly necessary for optimum developmental work along these lines.

5. A special analysis of the findings of the Pharmaceutical Survey should be made with reference to extracting and explicating those of its findings that are particularly relevant to valid measurement of achievement in pharmacy training. Measurements of achievement cannot be valid in the highest sense unless they are concerned with the demands placed upon pharmacists by their actual professional functions in pharmacies, laboratories, factories, hospitals, and elsewhere. What does a pharmacist need to know and be able to do to meet these demands? It is highly likely that the Pharmaceutical Survey will have furnished answers to this question more detailed and up-to-date than any heretofore available. These findings should be incorporated into examinations for pharmacists. The examinations will then yield measures of achievement that are more relevant to, and less remote from, pharmaceutical practice than those now in use.

#### IV. Pharmacy State Board Examinations Are Obsolete

The profession of pharmacy occupies a central position in the system of medical service that has evolved in Western civilization. Trends toward the specialization and professionalization of medical service have resulted in the rise of pharmacy as a science and technology with enormous responsibilities for human welfare. Consequently, the selection, education, and licensure of pharmacists have assumed an importance hardly exceeded in any field of professional activity.

These assertions will probably not be challenged by pharmacists. Nor will the close attention now being given by the Pharmaceutical Survey to the problems of selection and training be considered misplaced.

But what of the process of licensure? This is the point at which society makes its last inspection of the prospective pharmacist before giving him the freedom—and responsibility—to practice his profession. This is the last stronghold of the body politic against incompetence that may lead to ruin or loss of life. How well is this inspection being made? How well is the stronghold being guarded? These questions were called to our attention by E. C. Elliott, director of the Pharmaceutical Survey, as an integral part of the Student Personnel Studies of the Survey.

State board examinations are the means by which this inspection is now being made. That all is not as it should be with these examinations has become apparent to us in the course of becoming familiar with these instruments. Among pharmacists themselves there have been serious doubts about state board examinations. Thus, in his 1938 address as president of the National Association of Boards of Pharmacy, Robert L. Swain said:

I am convinced that much of the present state board examinations has little to do with the competency of a pharmacist, and they certainly must be looked upon as quite inadequate as a means of determining just how well the applicant has coped with the pharmaceutical curriculum.<sup>1</sup>

### *Diagnosis*

Let us list the faults of these examinations, both as pharmacists see them and from our own point of view as specialists in educational measurement and evaluation. This list of faults may not apply completely to every state board examination in every year. We think, however, that it is a fair indictment of the general, nation-wide situation as revealed by statements of pharmacists and by inspection of representative examinations.

1. The examinations take inadequate account of the existence of qualifying programs within the schools of pharmacy. Now that college graduation is required for eligibility to take state board examinations, should not the examinations attempt to supplement rather than duplicate the information concerning candidates that is available from records of college grades and examinations over a four-year period?

2. The examinations vary in validity from state to state and, within any state, from year to year. Validity is the degree to which an examination measures what it is intended to measure. It is the most important characteristic of any examination. The gross variations in test form and content that can be observed by even casual inspection of the examinations are enough to raise serious doubts about their validity. The examinations vary so widely that, if some are highly valid, then others assuredly are much less valid.

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<sup>1</sup> Robert L. Swain, Address of the President of the National Association of Boards of Pharmacy, Proceedings of the Thirty-Fifth Annual Convention of the National Association of Boards of Pharmacy, 1938. *American Journal of Pharmaceutical Education*, II (October 1938), 506.

3. The members of state examining boards are usually not sufficiently qualified to construct valid examinations. Usually board members have been away from colleges of pharmacy for at least five to ten years. They are not, and can hardly be expected to be, fully abreast of recent developments in the rapidly growing basic sciences on which pharmacy depends.

4. Furthermore, state board members are untrained in the technology of test construction. Even if their up-to-date pharmaceutical competence were guaranteed, to expect state board members to be skilled test-builders is as unreasonable as expecting test technicians to be competent pharmacists. Similarly, the conditions under which members of state boards are assembled are usually unfavorable to adequate examining. Highly valid examinations in pharmacy cannot be built in a few days of hasty work. And, as pharmaceutical laymen, the authors feel only slight hesitance in saying bluntly what seems to be an open secret among pharmacists: appointment to state boards is often a political plum given as patronage rather than on the basis of merit.

These criticisms of state boards are not mere conjecture. To provide material for the guidance of committees engaged in constructing comprehensive examinations for the Pharmaceutical Survey, the authors obtained from the secretary of the National Association of Boards of Pharmacy a representative sample of state board examinations. These were mimeographed as a ninety-one-page booklet and distributed to the persons concerned. A short time later the attention of the authors was called to the large number of errors that vitiated the entire collection. A check showed that the errors were not made in the mimeographing; the typist had faithfully copied the originals. The services of Dr. O. C. Lee, professor of pharmacy at Purdue University, were enlisted to obtain an error count. His results are shown in the following tabulation:

**Type-of-Error Count on a Random Sample of Pharmacy  
State Board Examinations in Each of the  
Curricular Areas\***

Type of Error	Frequency
Spelling .....	106
Capitalization .....	570
Grammar .....	21
Symbols .....	31
Proofreading .....	3
Latinization .....	27
Punctuation .....	242
Abbreviations .....	4
Wrong word or term .....	9
Not factual, confusing, or incomplete .....	12
Printing, typing, or spacing .....	29
Inconsistency in the use of Latin and/or English .....	9
Error in chemistry .....	3
Repetition .....	2
One part of the question answers another part of the same question .....	1

\*The specimen state board examinations in each of five major areas (pharmaceutical chemistry, pharmacy, pharmaceutical and chemical arithmetic, materia medica, and practical pharmacy) were furnished by the National Association of Boards of Pharmacy. The error count is based on approximately ten complete examinations in each area.

This result might well have been expected. Accurate examinations cannot result from the program typically followed for the assembling and the activities of state board examiners. The "repetition" type of error is especially noteworthy. Here the examiners in two different states had "lifted" whole sets of "model" questions from materials sent them by the secretary of the National Association of Boards of Pharmacy, despite specific injunctions from the latter that the specimen examinations were not to be used in this way, but were to serve only as guides.

5. The examinations are probably of inadequate reliability. (Reliability is the extent to which a test can be relied upon to give the same results upon repeated administrations; it is necessary, but far from sufficient, for validity.) In so far as state board examinations are of the "essay" or "long-answer" type, they are difficult to grade reliably. Examiners

will differ from each other, and one examiner will differ from himself in grading the same essay test paper at different times. These facts have been established and are unquestionably true of state board examinations since they require long answers to be graded by readers not rigorously trained.

6. The examinations are too restricted in their content to be highly valid. Any examination can, of course, contain only a sample of all the possible questions in a given field. In any sampling procedure, reliability depends on the size of the sample and on how the sample is chosen. Unless a sufficiently varied sample of scorable questions and problems is included in the examination, the total scores will not accurately reflect the candidate's mastery of the subject. The adequacy of sampling of content can be judged even by nonpharmacists simply from the number and kinds of questions in the state board examinations. In relation to their purpose the validity of the typical state board examination must be low because it contains too few questions of too few kinds. Accidents of emphasis in preparation by candidates or in selection of questions by examiners, when operating together with small numbers of questions, can cause grave injustices in the granting or withholding of licenses.

The authors' judgments concerning the invalidity and unreliability of state board examinations are admittedly subjective and unsupported by any competence in pharmacy. Although validity must always remain largely a matter of judgment, it would be relatively easy to verify experimentally our statements concerning the reliability of state board examinations. Because the issue is so important, it would be desirable to check these opinions against experimentally obtained facts. Accordingly, we have prepared the following set of proposed experimental designs.

*Proposed Designs for Studies of the Reliability  
of State Board Examinations in Pharmacy*

1. The purpose of these proposed studies would be to estimate the reliability of state board examinations. The re-



liability of examinations is crucial to their effective functioning inasmuch as it denotes the freedom from errors of measurement of the scores yielded by the examinations.

2. Each of the following designs could be replicated in several or all states. As here given, the design stipulates procedure for only one state at a time.

3. The following sources of error variance in state board examinations results may be hypothesized:

- a) Reliability of scoring or grading
- b) Reliability of sampling of examination content
- c) Reliability of candidate performance

4. In so far as the results of the examinations are expressed in terms of the dichotomy "pass-fail" and as an adequate proportion (that is, greater than 10 percent) of the candidates are failed, the coefficients of correlation may be computed by means of tetrachoric  $r$ .

5. The following methods of estimating reliability (see paragraphs A through F, which follow) each constitute a distinct operational definition of the concept. Choice among these methods should depend on the resources of professional cooperation available for this investigation and on the questions or challenges to be answered concerning the examinations.

**A. Reliability of grading**—(1) Develop or select representative candidates' papers in answer to one or more representative state board examinations. (2) Have papers graded by many state board examiners in the manner usually used by them. (3) Express reliability in terms of (a) dispersion of grades assigned same paper by various examiners, and (b) coefficients of correlation between grades assigned papers by various examiners.

**B. For relatively objectively scorable examinations**—(1) Secure separate scores for odd- and even-numbered questions for all candidates. (2) Express reliability in terms of corrected split-half coefficient of reliability.

**C. Reliability of sampling of content in time—**(1) Give each candidate two examinations, the actual one for the current year and a representative one for a preceding year. (2) Have same examiners grade both sets of examinations. (3) Express reliability in terms of coefficient of correlation between the two sets of grades.

**D. Reliability of sampling of content in time, and of grading—**Same as for "C" above, except that the two examinations will be graded by two separate boards of examiners. This type of reliability shows the variability in results due to both selection and grading of questions and reflects the amount of variation in results that a given candidate might expect from taking the examination one year under one board of examiners rather than another year under another board of examiners.

**E. Reliability of sampling of content by state, and of grading—**Same as for "D" above, except that the two examinations will be for the same year but from different states. This type of reliability reflects the amount of variation in results that a given candidate might expect from taking the examination in one state under one board of examiners rather than in another state under another board of examiners.

6. Following is a table of requirements for the experimental designs

Requirement	Method or Design				
	A	B	C	D	E
Candidates write more than one examination .....			X	X	X
Examinations graded more than once by many different examiners .....	X				
Examiners grade more than one set of papers .....			X		
Examinations graded to yield two split-scores .....		X			
More than one set of examiners required, each grading one set of papers .....	X			X	X

7. The designs or methods may be arranged in ascending order of the "amount of professional cooperation by boards of examiners required" as follows: B, D, E, C, A. (Method B is, of course, applicable only to objectively scorable examinations; otherwise, in "subjectively" scored, or "essay," tests, the split-half reliability will be spuriously raised by the "halo" effect.)

*Prescription*

If these shortcomings of state board examinations are admitted, or if the proposed experiments further demonstrate these flaws, what should be done?

Admittedly there are difficulties to be met in bringing about any changes—difficulties of a legal, political, and traditional, as well as professional, sort. These obstacles are well known to the profession of pharmacy and can in any event be more competently discussed by others than ourselves. We shall address ourselves to the technical problems in the development of valid and reliable examinations for the licensure of pharmacists.

What should be the nature of the examination for the licensure of pharmacists? The examinations should be maximally valid and reliable. This means that they should measure accurately those abilities, achievements, experiences, and other characteristics that are important in the practice of pharmacy.

1. Their content should consequently be determined in the light of the best current knowledge of requirements for the practice of pharmacy and of the theories and facts stemming from the sciences basic to the practice of pharmacy. Such information concerning what should go into the examinations should be obtained through a continuing analysis of the status and functioning of the profession. The interested reader is referred to a recent paper by the authors<sup>1</sup> for more specific statements of the considerations appropriate to the issue.

2. In form, the examinations should so far as possible be objectively scorable. That is, the questions should largely take the form of any of the numerous types of "short-answer" items that have been developed in the technology of psychological and educational measurements. Multiple-choice items, *if developed with sufficient ingenuity*, can be used for the measurement of most, if not all, of the types of ability and

<sup>1</sup> "Achievement and Predictive Testing in the Pharmaceutical Survey."

achievement that could justifiably be considered of concern in such an examination.<sup>3</sup> The use of such test questions would in itself vastly increase the reliability of the examination, by eliminating such sources of error as shifting grading standards of examiners from time to time, from state to state, and from examiner to examiner.

3. Furthermore, the examination should be maximally standardized as to administration. This implies standardization of directions, of the date and timing of the examinations, of the physical conditions (seating arrangement and the like) under which the examinations are given, and of all other conditions necessary to make the results comparable for all examinees.

4. It is anticipated that both "printed" and "performance" examinations will be necessary to cover the field adequately. These have also been called "theoretical" and "practical" examinations. The printed examinations would primarily emphasize those achievements, skills, and abilities that can be represented by symbols—verbal, mathematical, chemical, and so forth. The performance examination would primarily emphasize those motor and manipulative skills requisite to the laboratory aspect of the pharmacist's work, although Swain<sup>4</sup> has advocated that a written examination "be so designed as to elicit from the applicant his knowledge of the why and wherefore of the procedure which he adopts, together with a full explanation of the procedure itself." With this statement of one of the primary objectives of the printed examination the present authors altogether concur.

One recommendation of Dr. Swain was that more emphasis be given to the practical part of state board examinations. If this recommendation were followed, much additional attention would need to be paid to the possibilities of performance testing. Such testing can be as effectively standardized, valid, and reliable as the more usual printed tests. If state

<sup>3</sup>For illustrations and discussions of these types of items, see H. H. Remmers and N. L. Gage, *Educational Measurement and Evaluation* (New York: Harper & Bros., 1943), pp. 146-93.

<sup>4</sup>*Op. cit.*, p. 25

board examinations are used more to supplement, rather than duplicate, college records, our argument will be even more pertinent to the needs of adequate licensure procedures, and performance testing will be still further emphasized.

5. Other characteristics of the candidate for licensure in addition to his knowledges and skills will affect his success as a pharmacist. Traits of character and personality, intangible as they may seem, are nevertheless highly important and should be given due consideration in the process of licensure. A notable statement of this point has been made by Dr. Edward C. Elliott in an address before the American Association of Colleges of Pharmacy and the National Association of Boards of Pharmacy.<sup>5</sup> Data concerning these characteristics could well be obtained during the student's years in the college of pharmacy through systematic observation and records of students by their professors.

6. The examinations should be constructed and administered periodically *on a nation-wide basis*. This will insure comparability from state to state. Also, examining students throughout the nation will provide greater numbers on whom to base norms for interpreting examination scores. Similarly, such a nation-wide examination would make possible the consolidation of test-building and research facilities. The duplication of effort from one state to its neighbors will be eliminated. It is highly likely that the cost to individual states could be lower than at present. But the examinations resulting from such more efficient nation-wide examining could, nonetheless, be of vastly greater validity and reliability.

7. A continuing, nationally representative board of examiners in pharmacy should be established. The board would be responsible for constructing, administering and interpreting the national licensing examinations. To provide for the continuing research necessary to keep the examinations abreast of changes in pharmaceutical curriculums, the board would need liaison with national organizations for pharmaceutical

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<sup>5</sup> Elliott, "The Professional as a Person," *American Journal of Pharmaceutical Education*, (October 1946), 442-48.

education and practice. Such a board would need the services of at least one professionally trained specialist in testing and examining. Statistical and office equipment would provide for the printing, analysis, and research required in the continuous revision and refinement of the examinations. Authorities in the various areas of pharmaceutical education would be assigned responsibility for the content validity of the examinations. Teamwork of the testing and pharmacy specialists would result in examinations with validity and reliability far superior to any now available.

8. To allow for regional or other differences in scores on the national examination, each state or region would perhaps be allowed to set its own "cutting" scores, or failing and passing points. It is known from the results of the fall 1946 Predictive Testing Program of the Pharmaceutical Survey that there are significant differences among the various regions of the United States in the average scholastic abilities of the freshmen entering schools of pharmacy. Similar differences probably occur among the average achievements of the licensure candidates in the various regions. Hence, to preclude the possibility that a large proportion of any state's candidates would fail a national examination by standards set on a national basis, each state would continue as heretofore to set its own standards. But each state would now have a highly superior measuring stick for enforcing its standards. The advantages of "states rights" would be retained, therefore, along with the benefits of nation-wide examining. The problems of reciprocity among states would, of course, be materially reduced once all states could provide nationally meaningful data concerning their pharmacists.

In summary, pharmacy and the licensure of pharmacists are so important to the public welfare that only the best possible procedures in their practice are at all acceptable. In the light of this criterion, the present system of state board examinations is overdue for replacement by demonstrably superior techniques of measurement. A nation-wide system of licensure examining executed by continuing teamwork of specialists in pharmacy and in test technology is prescribed.



## V. The Future of Student Personnel Problems in Colleges of Pharmacy\*

### *Introduction*

The title of this paper is somewhat misleading unless one understands that to look into the future is made possible only by considering the past and the present. Accordingly, my discussion will concern all three—past, present, future.

For the first time in educational history, a fairly comprehensive qualitative and quantitative study of the intellectual dimensions of pharmacy freshmen was accomplished in the predictive testing program of the Pharmaceutical Survey carried out in the fall of 1946.<sup>1</sup> This survey of the raw materials in the way of intellectual assets coming into the schools of pharmacy was made possible by a rapidly developing science and technology in psychology and education related to student personnel problems. To quote from an earlier paper:

Personnel techniques available well before World War II and, of course, greatly developed during the war, have been extensively applied in other educational, industrial and military areas. They have been applied, however, only sporadically and institution-wise in pharmacy — at least if the paucity of published technical literature is any indication. Even on the basis of this institution-application, the available methodology has been shown to result in a marked improvement over what preceded the use of such methodology. This observation may be documented in such areas of education as medicine, general education, and engineering. Selection and classification of military personnel have, of course, given an object demonstration on a scale immensely more vast than would have been possible in education anywhere.<sup>2</sup>

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\* Prepared and read by H. H. Remmers before the Joint Session of the A. A. C. P., the N. A. B. P., and the A. Ph. A. at the San Francisco meeting, August 9, 1948.

<sup>1</sup> *The Abilities and Interests of Pharmacy Freshmen.*

<sup>2</sup> "Achievement and Predictive Testing in the Pharmaceutical Survey," pp. 43-44.

The general nature of the predictive testing program and the kinds of tests used are, I assume, well known to the teaching staffs of the schools of pharmacy in this country, since the large majority of them have probably had some experience in helping to administer the tests in the fall of 1946. The program, moreover, was described in detail in an earlier paper.<sup>3</sup> I shall, therefore, not review further this aspect of the program carried out and still in progress.

Instead, I wish to call particular attention to the word "predictive" in the phrase "predictive testing program" and to consider in some detail what it is that is to be predicted and the yardsticks or criterions of what is to be predicted.

#### *Yardsticks—Criterion Measures*

**Semester Marks:** The first of these yardsticks that comes to mind is, of course, the semester grade and the summation of such grades in the form of a grade-point average. This yardstick is known to have a number of very serious defects and limitations. In the first place, it is known to have low reliability—that is, a student's semester grade in a given course or subject would differ radically for two different instructors if each of them independently examined all the evidences of the student's achievement and independently appraised and graded these evidences. The reliability coefficient, as a matter of fact, is of the order of .7, or about 29 percent, better than a sheer guess such as we should have if we pulled grades for a given class out of a hat at random. It would be possible to outline in considerable detail the various factors that enter into this unreliability, but these are adequately treated in textbooks concerning educational and psychological measurement and, in any event, time does not permit. It is all summed up in the fact that the individual instructor's judgment is subject to very large errors.

A pioneer study bringing this out in sharp relief was carried out nearly forty years ago by two brashly inquiring young

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<sup>3</sup> *Ibid.*, pp. 54-62.

men at the University of Wisconsin — Edward C. Elliott and Daniel Starch. They sent facsimile copies of examinations written by a typical high school pupil in each of the various high school subjects to high school teachers teaching those subjects in accredited high schools, asking them to grade the papers on the then generally used percentage basis. Several hundred teachers graded each of the examinations and grades varied all the way from 25 percent to 95 percent for the same paper. The average error was of the order of five to ten percentage points; that is, it would be an even bet that two different teachers would be at least that far apart on the grading of a single paper; and, with slightly less favorable betting odds, much wider variations could be predicted.

Moreover, it is well known that the units of measurements in grading differ from institution to institution. The situation is analogous to what we should have if, in our basic sciences, we should indiscriminately mix up, say, avoirdupois, troy, and metric weight units, without specifying which was which. I continue to be amazed that even with this bad situation we do get substantial prediction even of semester grades and grade-point averages by means of our present tests. Improvement in prediction on this yardstick will come almost entirely through improvement, not in our predictive tests, but in the yardstick itself.

**Senior Comprehensive Examinations:** The known facts of the shortcomings of semester grades led logically to an attempt to design and construct an improved yardstick. The Senior Comprehensive Examinations in Pharmacy are such an attempt. Their design and construction were begun in the late summer of 1946, although the project was conceived some twelve years earlier—a fairly long gestation period for even such a complex entity as the examinations. Twelve years ago, Dr. Carl Klemme, then a member of the staff of the School of Pharmacy at Purdue University, had been invited by the A.A.-C.P. to become the chairman of a national committee on freshman aptitude testing in pharmacy. He consulted with me on

the matter, and I was able to convince him that the committee ought to be called the Committee on Predictive and Achievement Testing, a title which contained none of the biological overtones of the concept of "aptitude." At that time, Dr. Klemme and I developed, in the form of a lengthy memorandum, a proposal for the construction of a comprehensive achievement examination as preparatory to selecting and/or constructing predictive instruments. This, as I have just pointed out, was based on the reasoning that prediction would not be very much improved over what was already possible with currently available tests until a better criterion—that is, a better yardstick—had been developed. This memorandum was submitted to the American Council on Education and referred by them to a subcommittee consisting of Dr. W. W. Charters, Dr. Ralph W. Tyler, and Dr. Ben Wood who approved the proposed program—except for the fact that they said we had been too "Scotch" in setting up the budget and suggested that it be increased by some \$15,000. Our original budget estimate for the entire five-year program was something over \$80,000.

When, ten years later, Dr. Elliott came to see me to invite me to become responsible for the student personnel studies of the Pharmaceutical Survey, I was able to remind him that I did not need to do any of the basic thinking involved, since Dr. Klemme and I had already done that ten years previously.

Whether the Senior Comprehensive Examinations are the kind of superior instrument that they were planned to be will shortly begin to become evident, for the data from their administration last spring are now well along in being processed.

Before discussing these examinations further, I must pay tribute to the many men who so devotedly worked on the rather herculean task of constructing such examinations in accordance with the best-known principles of test construction. The final membership of the four subcommittees to work with the central office of student personnel studies in the construction of a 300-item examination in each of the four major areas of the pharmacy curriculum was as follows:

Subcommittee on Pharmacology

- L. D. Edwards, **chairman**, professor of pharmacology, School of Pharmacy, Purdue University  
H. B. Haag, professor of pharmacology and physiology, and dean, School of Medicine, Medical College of Virginia  
R. Blackwell Smith, Jr., dean, School of Pharmacy, Medical College of Virginia

Subcommittee on Pharmacognosy

- Ralph F. Voigt, **chairman**, associate professor of pharmacognosy and pharmacology, College of Pharmacy, University of Illinois  
E. H. Wirth, late professor of pharmacognosy and pharmacology, College of Pharmacy, University of Illinois  
Marin S. Dunn, professor of biology, Philadelphia College of Pharmacy and Science  
A. H. Musick, professor of pharmacognosy and botany, School of Pharmacy, University of Tennessee

Subcommittee on Pharmacy

- C. V. Netz, **chairman**, professor of pharmacy, University of Minnesota  
A. I. White, associate professor of pharmacy and pharmaceutical chemistry, Washington State College  
E. P. Guth, professor of pharmacy, Ohio State University

Subcommittee on Pharmaceutical Chemistry

- Lloyd M. Parks, **chairman**, professor of pharmaceutical chemistry, University of Wisconsin  
George Webster, professor of chemistry, College of Pharmacy, University of Illinois

In addition to these subcommittees, other members of the profession were, at my request, selected and appointed as expert consultants to review and criticize the work of the subcommittees. These consultants for the various subcommittees are as follows:

Pharmaceutical Chemistry

- LeRoy Keagle, New Jersey College of Pharmacy  
Harold G. Hewitt, University of Connecticut  
Frederick F. Blicke, University of Michigan

Pharmacognosy

- Arthur E. Schwarting, University of Nebraska  
Edward P. Claus, University of Pittsburgh  
Heber W. Youngken, Jr., University of Washington

Pharmacology

H. L. Reed, Massachusetts College of Pharmacy  
C. H. Waldon, University of Montana  
H. G. O. Holck, University of Nebraska

Pharmacy

Henry M. Burlage, University of Texas  
Ralph Clark, University of Kansas  
Nicholas W. Fenney, University of Connecticut

These committees, without financial compensation and under the terrific handicaps of the teaching overloads of the last two years, have rendered professional service of the highest order. The task of building objectively scorable test items must have been to them, at least initially, because unfamiliar, an annoying form of activity.

Let us review briefly the steps in the construction of these examinations.

1. First was a clear and detailed statement of the general and specific instructional objectives for a given course, or area of instruction, to be stated in terms of ways in which a student shall behave differently after the instruction than he did before.

2. A table of specifications was then prepared, outlining in detail how the instructional content was to be geared to the instructional objective. In the case of each heading and sub-heading in the outline, a percentage weighting had to be agreed upon among the committee members to indicate the relative importance of the topic.

3. Test questions were then prepared of the objective machine-scorable variety—each designed to test achievement of a particular objective as given in the outline. Through the chairman of the subcommittee these were then transmitted to the central office for editing and transmittal to the expert consultants, whence they were returned to the chairmen of the subcommittees via the central office.



4. A final revision in the light of all the criticisms was then made and resubmitted to the central office for final editing as to mechanics of the test items, English, and the like, but not, of course, for technical content.

Since all of this work had to be carried on by correspondence, it was laborious and time-consuming. We did, however, succeed in getting all but 67 of the 1,200 test items that were originally projected. These were administered last spring, and the results are now being processed.

This processing has the following purposes:

1. To provide the participating schools of pharmacy with the results of the examinations, to serve such purposes of appraisal as they might have in mind, for example, as a partial determinant of grades in the last semester or year. The scoring was done promptly upon receipt of the answer sheets so that within twenty-four hours of the receipt of the answer sheets, a list of the scores on each of the four examinations was in the mail to the school of pharmacy in question.

2. Ultimately of more importance than this preliminary service to the schools of pharmacy was the appraisal of the examination as a measuring instrument—to use our technical jargon, to establish its reliability and validity. Without going into the technical details, suffice it to say that each of the 1,133 test items is rigorously tested in a strength-of-materials laboratory to test its difficulty and its power to discriminate among good and poor students who took the examination. This will presumably lead to the elimination of some ineffective items and the possible revision of others if and when these results are made available to the subcommittees on the Senior Comprehensive Examinations.

Each of the four examinations—in pharmacy, pharmacology, pharmaceutical chemistry, and pharmacognosy—will also be evaluated for its reliability and with respect to its psychological relationship with each of the other three parts of the examination.

Here I should like to make, with all possible emphasis, the point that, to realize the major possible benefits of these comprehensive examinations, the revised and improved forms should have another "dry run" for further improvement next spring and, more important, should be administered to those entering in 1946 who survived to the spring of 1950, since it was for this group that this achievement examination was conceived as a criterion measure. Without this final testing of the tests, a major portion of the possible gains from the entire program will be lost. If, at the same time in 1950, the predictive tests given in 1946 could be repeated with the graduating group, we should have data of far-reaching importance—both practically and theoretically—in that we should have measures of (1) the amount and direction of change in the mental functions measured by the predictive tests over a four-year period, (2) the predictiveness of these tests over a four-year period, and (3) data that will tell us how predictive these tests are when the four-year time interval is omitted as a variable. Such knowledge would be extremely useful in further research and development.

As matters stand at present, there is no budget to carry on beyond September 1948.

Certain problems concerning the Comprehensive Senior Examinations have still to be resolved, particularly that of the relative weight of each of the four examinations. Should they all have the same weighting, or is one more important than another and if so, by how much? The difficulty here is that each of the subject-matter specialists constitutes also a psychologically vested interest. Each is, and no doubt ought to be, convinced that his particular area is at least as important as any other and probably more so. The only solution that I have been able to come up with is to have a committee of deans of pharmacy, perhaps assisted by practicing pharmacists, all of whom are presumably above the battle, to judge the relative weight of each of the four examinations and to take their consensus in establishing these relative weights. There are other approaches theoretically possible but practically not very feasible.

Another problem concerning the comprehensive examinations is that of including in them examination questions based upon other unit studies of the Pharmaceutical Survey. This matter, too, has already been discussed in an earlier paper,<sup>4</sup> where some seventeen unit studies proposed at the outset of the Pharmaceutical Survey are listed as important sources of valid test items for prospective pharmacists. I shall not repeat the list of proposed studies except to point out that such studies—for example, “a spot analysis of present day prescriptions to determine the knowledge required in compounding them,” “A study of the new fields of pharmaceutical service with their implications both for training and for employment. Need for diversification and specialization of training,” “A study of the activities engaged in by selected groups of pharmacists: professional, commercial, civic, etc.” “A study of the role of pharmacy in medical care,”—are illustrations of sources from which the comprehensive examinations should be enriched and validated. The work of Dr. Blauch on the curriculum and that of the Committee on Curriculum obviously also needs to be taken into account. Fortunately, some members of the Committee on Curriculum are also members of the Committee on the Comprehensive Senior Examinations.

The guidance implications of the results of such improved examinations need not be elaborated here. Obviously, to the extent that valid predictions are possible, we have not only the right, but the duty, to use such knowledge both in guiding young men and women into and out of pharmacy, as well as carrying on differential guidance within the pharmacy curriculum and among different pharmacy careers.

**Pharmacy State Board Examinations:** In characterizing pharmacy state board examinations, I had originally intended to quote extensively from a paper as yet unpublished.<sup>5</sup> But both because of the limitations of time and as the result of a conference with Dr. Elliott, I shall make only a necessarily dogmatic statement here.

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<sup>4</sup> *Ibid.*

<sup>5</sup> Now published as the preceding paper (“IV. Pharmacy State Board Examinations Are Obsolete”) in this series.

The faults of these examinations both as seen by pharmacists and the specialists in educational measurement are briefly as follows.

1. They take inadequate account of the existence of qualifying programs within the schools of pharmacy.
2. They vary in validity from state to state and within any state from year to year.
3. The board members are generally not adequately qualified either as pharmacists or as technical experts in test construction.
4. The examinations are too restricted in content to be highly valid.
5. They are probably not sufficiently reliable.

In sum, both the examiners and the examinations fall alarmingly short of the professional and technical standards that the profession owes and that society has a right to demand. If these shortcomings of state board examinations are admitted, what should be done?

To summarize briefly the prescription as given in the preceding paper, "Pharmacy State Board Examinations Are Obsolete":

1. Content of the examinations should accord with the best current knowledge of requirements for the practice of pharmacy;
2. The examinations should be reliably scored and maximally standardized as to administration;
3. Both "theoretical," or printed, and "practical," or performance, examinations on necessary skills should be used;
4. Traits of personality and character should be given due consideration;

5. The examinations should be on a nation-wide basis; and finally

6. A continuing nationally representative board of examiners with adequate technical staff should be established.

**Success as a Pharmaceutical Practitioner and Citizen:** This yardstick is, of course, in theory the completely valid yardstick of achievement. Its chief difficulty is that of defining it operationally—that is, in terms of things that pharmacists actually do or do not do on the job, both as professional practitioners and as citizens in the community. The best practicable approximation of this yardstick would be some combination of the Senior Comprehensive Examinations and the proposed improved state board examinations, each kept thoroughly abreast of the technological and social changes continually going on. This means a continuing research task.

#### *A Continuing Mechanism Proposed*

From the foregoing, it is obvious that a continuing mechanism would be necessary to carry on testing for purposes of selection, guidance, placement, licensure, and so forth. The two major functions of such a continuing mechanism are *service* and *research*. The requirements of the service function are chiefly speed, promptness, and accuracy in providing data for selection, counseling, and placement in courses and curriculums. I gathered from conversation with Dr. Elliott that a council of pharmaceutical education recommended by the Survey could well function in this capacity. This board would be responsible for determining policy with respect to predictive and achievement testing and possibly, in time, for administering and interpreting the national licensing examinations.

It would be highly desirable to have this bureau of educational research in pharmacy located in an institution that has a school of pharmacy, so that the new materials could be tried out in a continuing developmental program.

How is such a mechanism to be financed? My colleague, Dean Jenkins, estimated that in round numbers there would be six thousand freshmen entering schools of pharmacy in September 1948 plus some two thousand transfers at the sophomore-year level. At \$5.00 per student, this would provide an annual budget of \$40,000, an amount ample to carry out the service function briefly indicated above, as well as considerable research. Only the experience and the imagination of the proposed board and executive director can determine the extent and cost of all research related to pharmaceutical education. In any event, \$5.00 per student is a very modest sum, in the light of the benefits to pharmaceutical education and to society that are to be anticipated from the operation of such a mechanism. It is not inappropriate here to remind you that for similar services the Veterans Administration is paying counseling centers all over the country from \$20.00 to \$25.00 per veteran tested and counseled.

Serious problems of both a theoretical and practical nature face the implementation of the program here proposed. For example, the administration of a separate battery of predictive tests—when higher education as a whole is considered—poses a definite practical problem. As the test movement has developed, the pattern has been that of choosing a set of likely predictors for a particular criterion, particularly in professional curriculums, so that there is already a multiplicity of testing programs both within and among institutions. Well-known examples of interinstitutional testing programs are those in medicine, dentistry, and engineering, all three of which are on a national basis. Only the engineering program, of these three, has a freshman predictive testing program. It is likely, however, that in the areas of higher education, in commerce education, nursing, journalism, fine arts, physical education, law, and possibly others, testing programs are being or will be envisaged in the future.

A first approximation of the solution to this problem would be for representatives of all curriculums concerned to join in recommending a common battery of tests predictive of success in the freshman college year.



As the testing movement in higher education is now developing, and in so far as such testing programs are at the beginning of the freshman year, they tend to create an impossible administrative situation in terms of the cost in time and materials, as well as the problem of scheduling examinations.

If it be proposed that a postadmission testing program be adopted for pharmacy, say at the end of the first or second year, the ethical problem of meeting social needs versus respecting individual rights arises. From the point of view of society's needs it may be advantageous to make selections for admission for professional curriculums as late as possible in order to have more valid prediction of success in professional training. From the point of view of the individual, however, such procedure leaves much to be desired and society owes it to him to let him know as soon as possible whether he will be admitted to the professional curriculum or not.

If a pre-admission testing program be proposed, it would mean pushing the testing program back to the senior high school year, with the obvious problem of getting tests administered under acceptably standard conditions.

Other problems of a more theoretical nature could be listed, but time forbids. All these problems are vexing ones. The crucial importance of pharmacy as a profession demands that they be faced and solved.

## APPENDIXES

*Appendix A*Tables Related to "Prediction of  
Scholastic Mortality"

TABLE I

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and A.C.E. Psychological  
Examination, Total Scores

Following is a list of the symbols used in Tables I-XIX:

$N_t$	= Total number of enter- ing students	$M_w$	= Mean score of with- drawing students
$N_w$	= Number of withdrawing students	S.D.	= Standard deviation of scores of entering stu- dents
$p_w$	= Proportion of students withdrawing	$r_{bi}$	= Biserial coefficient of correlation
$M_t$	= Mean score of entering students		

College No.	$N_t$	$N_w$	$p_w$	$M_t$	$M_w$	S.D.	$r_{bi}$
1.....	87	16	.184	127.10	111.05	21.75	.511
2.....	137	20	.146	123.55	114.50	19.85	.291
4.....	142	29	.204	117.07	119.75	21.42	-.090
6.....	81	25	.309	113.75	109.20	17.25	.232
9.....	51	30	.588	113.65	101.50	21.50	.854
10.....	85	43	.506	112.25	103.30	21.75	.522
11.....	89	9	.101	112.20	99.80	22.65	.312
12.....	84	15	.179	112.65	106.00	24.85	.184
13.....	44	8	.182	108.15	99.50	20.80	.287
16.....	58	19	.328	109.65	104.90	22.70	.190
17.....	86	40	.465	109.15	106.25	18.93	.179
18.....	107	5	.047	107.95	97.00	22.30	.235
19.....	155	38	.245	106.10	94.25	23.06	.400
20.....	177	24	.136	106.20	92.85	23.80	.350
21.....	89	29	.326	101.15	88.40	21.20	.544

TABLE I — Continued

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and A.C.E. Psychological  
Examination, Total Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
23.....	99	13	.131	105.15	102.40	23.10	.073
24.....	92	21	.228	104.95	91.75	23.10	.431
27.....	90	36	.400	103.22	98.80	21.30	.215
29.....	24	2	.083	100.35	79.50	19.90	.569
30.....	44	9	.205	101.90	78.10	20.70	.830
33.....	88	15	.170	97.51	78.65	22.07	.575
38.....	48	18	.375	92.21	85.05	20.61	.343
39.....	35	12	.343	92.40	87.40	23.22	.201
41.....	43	11	.256	78.15	61.10	28.00	.484
43.....	189	21	.111	75.84	64.60	21.26	.311
45.....	82	17	.207	105.66	97.00	25.52	.245

TABLE II

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and A. C. E. Psychological  
Examinations, Q-Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1.....	87	16	.184	49.87	44.74	10.44	.340
2.....	137	20	.146	47.69	43.50	9.15	.292
4.....	142	29	.204	44.26	46.60	10.08	-.167
6.....	81	25	.309	41.45	39.58	9.07	.181
9.....	51	30	.588	43.07	38.82	11.73	.547
10.....	85	43	.506	42.39	37.20	11.38	.569
11.....	89	9	.101	41.95	40.18	10.48	.096
12.....	84	15	.179	40.74	36.70	11.53	.240
13.....	44	8	.182	39.23	38.02	10.10	.083
16.....	58	19	.328	41.36	37.70	11.18	.297

**TABLE II** — Continued

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and A.C.E. Psychological  
Examination, Q-Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
17.....	86	40	.465	45.55	45.42	9.17	.016
18.....	107	5	.047	39.93	39.10	10.78	.038
19.....	155	38	.247	38.25	31.82	10.85	.464
20.....	177	24	.136	40.96	36.02	11.00	.280
21.....	89	29	.326	39.16	33.62	11.46	.437
23.....	99	13	.131	40.21	37.82	11.66	.126
24.....	92	21	.228	39.85	38.26	10.84	.041
27.....	90	36	.400	40.52	37.38	9.90	.330
29.....	24	2	.083	38.33	27.50	7.92	.742
30.....	45	9	.200	40.08	28.18	11.63	.730
33.....	88	15	.170	36.32	27.38	11.30	.532
38.....	48	18	.375	34.08	31.26	9.13	.306
39.....	35	12	.343	35.56	32.18	12.92	.244
41.....	43	11	.256	27.92	21.50	11.48	.445
43.....	189	21	.111	31.62	27.22	11.10	.232
45.....	83	17	.205	41.55	38.66	11.12	.188

**TABLE III**

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and A. C. E. Psychological  
Examination, L-Scores

No. College	<sup>t</sup> N	<sup>w</sup> N	<sup>w</sup> p	<sup>t</sup> M	<sup>w</sup> M	S.D.	bi r
1.....	87	16	.184	77.52	66.70	15.68	.036
2.....	137	20	.146	75.98	75.50	14.93	.020
4.....	142	29	.204	73.27	73.55	14.06	-.014
6.....	81	25	.309	72.68	70.20	13.11	.166
9.....	51	30	.588	70.14	65.65	12.46	.544
10.....	85	43	.506	70.41	65.95	13.45	.421
11.....	89	9	.101	70.26	59.80	14.63	.408
12.....	84	15	.179	72.30	69.00	16.51	.137
13.....	44	8	.182	68.71	60.15	13.40	.440
16.....	58	19	.328	68.21	67.80	15.08	.025
17.....	86	40	.465	64.10	61.75	13.38	.206
18.....	107	5	.047	67.98	58.00	14.90	.321
19.....	154	38	.247	67.81	62.00	15.26	.298
20.....	176	24	.136	65.53	57.00	15.23	.349
21.....	89	29	.326	61.65	54.05	16.65	.413
23.....	99	13	.131	65.03	65.46	15.16	-.017
24.....	92	21	.228	64.88	53.90	15.51	.535
27.....	90	36	.400	62.95	61.60	15.03	.093
29.....	24	2	.083	62.84	54.50	16.05	.282
30.....	45	9	.200	58.00	49.20	11.96	.526
33.....	88	15	.170	61.66	51.65	13.71	.491
38.....	48	18	.375	57.73	53.65	15.54	.260
39.....	35	12	.343	57.00	54.90	14.44	.135
41.....	43	11	.256	49.91	38.80	18.60	.475
43.....	189	21	.111	44.60	37.50	13.98	.300
45.....	83	17	.205	64.11	58.45	16.63	.245

TABLE IV

Data Used in Computing Biserial Coefficients of  
Correlation between Withdrawal-Remaining and  
Cooperative English Test, Form PM, Total Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1.....	86	15	.174	58.50	54.39	7.32	.380
2.....	139	20	.144	57.39	55.20	8.25	.168
4.....	143	29	.203	54.87	54.42	8.13	.039
6.....	81	27	.333	54.48	53.67	8.88	.083
9.....	51	29	.569	54.36	51.63	7.20	.549
10.....	90	47	.522	54.60	52.59	9.54	.277
12.....	84	15	.179	56.37	54.60	8.19	.148
13.....	44	8	.182	54.48	53.25	8.31	.101
17.....	87	41	.471	51.48	49.98	7.98	.221
18.....	108	5	.046	50.07	42.00	8.10	.477
19.....	154	38	.247	55.53	51.72	8.82	.338
20.....	176	24	.136	53.61	50.37	9.42	.215
21.....	89	29	.326	52.14	47.70	10.14	.397
23.....	99	13	.131	50.52	49.38	8.55	.082
24.....	92	21	.228	54.99	50.58	8.19	.406
26.....	26	12	.462	55.38	54.51	11.31	.089
27.....	89	37	.416	52.56	52.38	9.72	.020
29.....	24	2	.083	50.76	42.00	10.08	.472
30.....	46	9	.196	49.62	44.01	9.33	.426
33.....	88	15	.170	51.33	45.99	9.30	.386
38.....	48	18	.375	51.18	47.67	8.55	.406
39.....	33	10	.303	49.56	45.30	8.55	.432
41.....	38	9	.237	46.50	42.66	10.02	.294
43.....	187	21	.112	43.49	38.13	8.74	.360
44.....	68	23	.338	55.11	55.44	9.12	-.033
45.....	64	15	.234	49.26	48.21	9.54	.084



**TABLE V**

Data Used in Computing Biserial Coefficients of  
Correlation between Withdrawal-Remaining and  
Cooperative English Test Scores, Form PM, Part I

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1.....	86	15	.174	56.20	52.20	7.28	.372
2.....	139	20	.144	53.03	49.65	7.72	.278
4.....	143	29	.203	49.41	49.98	7.19	-.057
6.....	81	27	.333	51.52	50.55	9.27	.096
9.....	51	29	.569	50.77	48.30	7.87	.455
10.....	90	47	.522	52.17	51.18	8.87	.147
12.....	84	15	.179	53.43	49.20	9.49	.306
13.....	44	8	.182	50.18	49.89	7.47	.027
17.....	87	41	.471	47.86	46.89	7.98	.144
18.....	108	5	.046	45.31	38.40	7.41	.445
19.....	154	38	.247	50.59	46.41	7.94	.411
20.....	176	24	.136	48.82	45.39	9.04	.236
21.....	89	29	.326	49.89	46.23	9.97	.332
23.....	99	13	.131	47.61	49.14	7.48	-.126
24.....	92	21	.228	52.43	48.57	8.95	.325
26.....	26	12	.462	53.19	51.24	9.90	.229
27.....	89	37	.416	51.77	49.53	9.57	.250
29.....	24	2	.083	46.00	43.50	8.39	.162
30.....	46	9	.196	46.83	39.33	8.28	.642
33.....	88	15	.170	47.32	41.19	8.11	.508
38.....	48	18	.375	48.56	44.34	8.88	.470
39.....	33	10	.303	47.73	42.90	7.94	.528
41.....	38	9	.237	43.19	39.66	10.94	.248
43.....	187	21	.112	41.28	35.58	8.58	.390
44.....	68	23	.338	52.63	53.22	8.49	-.154
45.....	64	15	.234	47.67	47.01	9.26	.054

TABLE VI

Data Used in Computing Biserial Coefficients of  
Correlation between Withdrawal-Remaining and  
Cooperative English Test Scores, Form PM, Part II

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1.....	86	15	.174	54.99	51.39	9.12	.268
2.....	139	20	.144	55.44	55.05	9.66	.025
4.....	143	29	.203	53.94	53.70	9.67	.018
6.....	81	27	.333	52.08	51.99	10.55	.008
9.....	51	29	.569	52.23	49.86	8.65	.396
10.....	90	47	.522	51.27	48.96	12.60	.240
12.....	84	15	.179	54.75	54.81	8.15	-.005
13.....	44	8	.182	53.79	54.39	10.74	-.039
17.....	87	41	.471	50.34	50.04	10.13	.036
18.....	108	5	.046	48.18	43.20	11.16	.213
19.....	154	38	.247	54.75	51.24	10.92	.251
20.....	176	24	.136	53.73	50.76	11.52	.161
21.....	89	28	.315	50.28	48.42	12.17	.136
23.....	99	13	.131	49.08	46.38	12.27	.136
24.....	92	21	.228	52.53	48.30	9.39	.340
26.....	26	12	.462	52.74	54.00	12.60	-.116
27.....	89	37	.418	49.53	50.76	11.91	-.110
29.....	24	2	.083	47.76	34.50	12.13	.593
30.....	46	9	.196	47.10	42.66	12.27	.257
33.....	88	15	.170	50.28	45.99	12.00	.241
38.....	48	18	.375	49.14	45.00	10.70	.383
39.....	33	10	.303	48.90	43.80	10.16	.436
41.....	38	9	.237	46.59	41.34	12.39	.326
43.....	187	21	.112	45.66	42.57	9.93	.183
44.....	68	23	.338	52.41	53.61	11.54	-.096
45.....	64	15	.234	44.49	42.81	12.23	.105

**TABLE VII**

Data Used in Computing Biserial Coefficients of  
Correlation between Withdrawal-Remaining and  
Cooperative English Test Scores, Form PM, Part III

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1.....	86	15	.174	62.37	58.20	9.74	.290
2.....	139	20	.144	62.22	59.85	10.29	.146
4.....	143	29	.203	61.26	60.72	10.26	.038
6.....	81	27	.333	58.44	57.00	9.60	.137
9.....	51	29	.569	59.30	56.91	8.26	.418
10.....	90	47	.522	58.93	56.88	9.43	.284
12.....	84	15	.179	59.68	58.20	9.17	.110
13.....	44	8	.182	58.37	54.75	9.52	.262
17.....	87	41	.471	56.03	53.55	9.48	.310
18.....	108	5	.046	56.50	45.60	10.10	.515
19.....	154	38	.247	60.33	57.48	10.73	.208
20.....	176	24	.136	57.73	56.37	10.29	.082
21.....	89	29	.326	55.72	49.35	11.48	.407
23.....	99	13	.131	54.85	53.55	9.80	.082
24.....	92	21	.228	58.40	53.85	9.24	.371
26.....	26	12	.462	59.66	57.99	13.16	.148
27.....	89	37	.416	55.19	56.58	9.37	-.045
29.....	24	2	.083	59.25	54.00	12.44	.229
30.....	46	9	.196	55.04	50.01	9.17	.389
33.....	88	15	.170	56.49	51.60	9.71	.339
38.....	48	18	.375	55.19	53.82	9.85	.137
39.....	33	10	.303	52.55	50.40	10.19	.183
41.....	38	9	.237	49.34	47.01	7.84	.228
43.....	187	21	.112	45.27	39.72	10.07	.324
44.....	68	23	.338	59.47	59.34	8.78	.014
45.....	64	15	.234	54.94	53.40	10.59	.111

TABLE VIII

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and Purdue Physical  
Science Test, Form AM, Total Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1	89	17	.191	81.35	68.75	13.15	.673
2	149	22	.148	77.65	71.10	13.45	.312
4	143	29	.203	73.35	70.30	12.60	.174
6	81	25	.309	71.50	67.80	14.40	.226
9	51	30	.588	74.55	68.50	12.15	.752
10	89	46	.517	73.80	68.65	13.30	.502
11	91	12	.132	70.95	63.65	14.75	.304
12	83	15	.181	76.80	74.65	14.75	.100
13	48	8	.167	73.88	71.40	12.44	.133
16	58	19	.328	72.50	67.25	12.15	.392
17	86	41	.477	68.35	65.55	12.20	.276
18	107	5	.047	70.85	61.00	13.75	.343
19	154	38	.247	72.85	64.65	14.95	.429
20	176	24	.136	71.35	66.60	12.70	.233
21	83	28	.337	62.25	52.00	14.25	.664
22	78	28	.359	68.45	62.20	14.55	.413
23	99	13	.131	72.65	75.85	13.20	-.149
24	92	21	.228	72.85	68.20	12.75	.276
25	54	10	.185	71.65	65.00	13.10	.352
26	28	14	.500	73.45	70.55	11.30	.321
27	90	37	.411	71.15	67.40	14.00	.283
29	25	2	.080	63.40	52.00	15.70	.391
30	45	9	.200	64.55	55.90	13.75	.449
33	89	15	.169	64.60	55.35	13.70	.453
38	49	19	.388	57.40	56.45	14.55	.066
39	34	12	.353	59.80	58.25	12.35	.120
41	40	11	.275	54.75	46.10	12.70	.560
43	189	22	.116	61.24	53.35	13.21	.355
44	69	24	.348	72.95	72.65	14.00	.020
45	81	19	.235	71.20	64.10	14.35	.379
46	84	19	.226	73.75	70.15	18.50	.147
47	47	10	.213	70.85	71.00	12.70	-.009
48	106	32	.302	78.00	77.95	14.30	.003

TABLE IX

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and Purdue Mathematics  
Training Test, Form XM, Total Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1.....	88	16	.182	46.74	37.50	11.17	.570
2.....	148	23	.155	35.39	29.85	10.38	.347
4.....	143	29	.203	32.14	29.90	10.52	.153
6.....	81	27	.333	30.70	26.38	10.24	.387
9.....	51	30	.588	31.50	27.22	10.16	.636
10.....	90	47	.522	32.62	28.66	10.64	.488
11.....	92	11	.120	33.94	27.70	10.08	.371
12.....	83	15	.181	37.34	34.30	9.78	.215
13.....	47	8	.172	37.74	37.00	10.96	.046
16.....	58	19	.328	35.50	30.98	11.44	.359
17.....	86	41	.477	28.70	27.74	11.60	.099
18.....	108	5	.046	33.54	30.30	8.84	.174
19.....	154	38	.247	32.14	27.06	11.52	.345
20.....	176	24	.136	36.10	28.82	10.64	.426
21.....	83	27	.325	26.86	23.74	8.92	.316
23.....	99	13	.131	34.70	31.04	9.80	.230
24.....	93	21	.226	34.82	29.30	11.84	.350
25.....	54	10	.185	32.76	27.90	10.83	.311
26.....	28	14	.500	37.94	34.66	12.08	.341
27.....	91	38	.418	34.54	31.30	10.76	.322
29.....	25	2	.080	29.66	15.50	10.84	.705
30.....	46	9	.196	29.42	23.74	8.68	.464
33.....	89	15	.169	26.62	22.02	8.64	.356
38.....	49	19	.388	27.54	25.50	8.52	.242
39.....	34	12	.353	26.46	23.82	9.00	.278
41.....	40	11	.275	23.70	14.94	11.36	.635
43.....	191	22	.115	28.45	22.06	8.59	.441
44.....	73	26	.356	32.30	33.02	11.28	-.079
45.....	82	17	.207	28.14	27.62	10.40	.036
47.....	47	10	.213	29.14	24.70	8.56	.380
48.....	106	32	.302	34.94	34.02	11.12	.072

TABLE X

Data Used in Computing Biserial Coefficients of Correlation  
between Withdrawal-Remaining and Pharmacy Background  
and Personal Data Test, Total Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
1	89	17	.191	28.54	28.10	6.18	.050
2	149	23	.154	30.78	29.86	6.91	.086
4	143	29	.203	28.30	28.26	4.88	.005
6	81	27	.333	27.38	27.42	5.14	-.007
9	51	29	.569	27.36	25.62	6.28	.401
10	89	45	.506	26.00	24.25	5.60	.397
11	91	12	.132	29.66	29.82	5.02	-.020
12	82	15	.183	27.26	24.98	5.68	.277
13	47	9	.191	27.86	25.94	5.74	.234
16	58	19	.328	26.16	25.70	7.36	.057
17	86	41	.477	28.16	27.34	5.56	.176
18	108	5	.046	29.32	32.70	7.02	-.229
19	154	38	.247	28.14	27.30	6.00	.110
20	176	24	.136	29.46	29.66	5.78	-.022
21	83	28	.337	26.38	23.34	7.02	.400
22	76	28	.368	24.76	22.22	6.96	.356
23	99	12	.121	26.64	25.50	6.92	.099
24	92	20	.217	28.52	28.30	4.10	.040
25	54	10	.185	25.90	21.10	5.80	.574
26	28	14	.500	26.92	26.06	6.26	.172
27	90		.600	26.72	25.06	6.18	.278
29	25	2	.080	21.86	15.50	8.28	.413
30	46	9	.196	25.06	25.06	5.18	.000
33	90	15	.167	27.66	26.82	7.08	.079
38	49	19	.388	23.76	22.54	7.62	.162
39	34	12	.353	26.32	22.83	5.66	.586
41	37	11	.297	21.52	19.70	7.48	.208
43	122	22	.180	19.14	17.70	6.21	.159
44	73	26	.356	27.84	27.02	5.02	.156
45	80	18	.225	28.78	28.18	4.18	.108
46	82	18	.220	29.28	28.62	3.78	.129
47	47	10	.213	27.60	28.70	4.94	-.163
48	106	31	.292	27.34	26.78	6.04	.079



TABLE XI

Biserial  $r$ 's of Withdrawal-Remaining  
and Mechanical Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24	92	21	.228	62.06	69.81	20.21	-.289
21	89	29	.326	68.12	66.34	19.38	.083
39	35	12	.343	69.67	68.17	18.20	.077
11	92	12	.130	66.54	66.00	20.46	.016
25	54	10	.185	67.65	67.60	15.79	.002
22	80	29	.363	53.50	53.86	23.23	-.015
30	46	9	.196	63.93	63.00	20.65	.032
29	24	2	.083	68.17	75.50	19.52	-.204

TABLE XII

Biserial  $r$ 's of Withdrawal-Remaining  
and Computational Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24	92	21	.228	33.34	36.38	9.59	-.239
21	89	29	.326	32.27	31.48	10.31	.070
39	35	12	.343	33.01	28.25	9.71	.457
11	92	12	.130	35.28	32.50	11.77	.145
25	54	10	.185	35.31	37.60	10.33	-.154
22	80	29	.363	29.87	31.10	11.96	-.100
30	46	9	.196	36.58	33.33	9.62	.240
29	24	2	.083	30.08	24.50	10.33	.293

**TABLE XIII**

Biserial  $r$ 's of Withdrawal-Remaining  
and Scientific Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24 .....	92	21	.228	78.97	78.05	13.18	.053
21 .....	89	29	.326	72.93	69.90	16.23	.169
39 .....	35	12	.343	76.18	72.50	14.00	.245
11 .....	92	12	.130	78.32	70.58	14.45	.330
25 .....	54	10	.185	78.46	76.50	11.27	.121
22 .....	80	29	.363	70.05	72.17	16.24	-.127
30 .....	46	9	.196	74.72	72.44	15.35	.106
29 .....	24	2	.083	72.83	74.50	14.64	-.062

**TABLE XIV**

Biserial  $r$ 's of Withdrawal-Remaining  
and Persuasive Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24 .....	92	21	.228	65.42	68.90	17.10	-.154
21 .....	89	29	.326	64.19	67.66	17.07	-.184
39 .....	35	12	.343	68.14	72.67	18.29	-.231
11 .....	92	12	.130	74.50	74.17	19.60	.010
25 .....	54	10	.185	68.30	59.10	15.79	.404
22 .....	80	29	.363	59.75	62.97	19.79	-.158
30 .....	46	9	.196	70.04	65.00	18.55	.193
29 .....	24	2	.083	76.79	68.50	13.58	.331

**TABLE XV**

Biserial *r*'s of Withdrawal-Remaining  
and Artistic Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24.....	92	21	.228	41.40	41.10	16.97	.014
21.....	89	29	.326	45.37	41.41	14.28	.251
39.....	35	12	.343	47.43	46.25	9.29	.118
11.....	92	12	.130	46.62	51.00	15.17	-.178
25.....	54	10	.185	41.91	43.20	11.65	-.077
22.....	80	29	.363	37.88	40.52	15.24	-.167
30.....	46	9	.196	40.91	41.78	13.39	-.046
29.....	24	2	.083	46.38	56.00	11.30	-.462

**TABLE XVI**

Biserial *r*'s of Withdrawal-Remaining  
and Literary Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24.....	92	21	.228	42.98	43.71	16.33	-.034
21.....	89	29	.326	43.66	41.69	14.15	.126
39.....	35	12	.343	43.10	44.42	15.69	-.078
11.....	92	12	.130	47.41	45.83	17.77	.055
25.....	54	10	.185	43.80	47.10	14.17	-.161
22.....	80	29	.363	39.20	40.21	15.19	-.064
30.....	46	9	.196	42.98	38.00	14.83	.238
29.....	24	2	.083	47.67	48.00	12.70	-.014

**TABLE XVII**

Biserial  $r$ 's of Withdrawal-Remaining  
and Musical Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24.....	92	21	.228	17.60	16.33	9.70	.099
21.....	89	29	.326	16.90	17.79	9.66	-.083
39.....	35	12	.343	21.52	20.08	9.91	.135
11.....	92	12	.130	21.52	24.58	9.53	-.197
25.....	54	10	.185	19.57	20.20	10.14	-.043
22.....	80	29	.363	16.63	15.52	9.64	.111
30.....	46	9	.196	21.54	14.33	10.47	.489
29.....	24	2	.083	19.50	6.00	10.50	.698

**TABLE XVIII**

Biserial  $r$ 's of Withdrawal-Remaining  
and Social Service Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24.....	92	21	.228	72.49	74.67	18.22	-.091
21.....	89	29	.326	72.50	70.93	18.90	.075
39.....	35	12	.343	74.14	77.00	18.98	-.141
11.....	92	12	.130	76.02	77.67	19.33	-.052
25.....	54	10	.185	71.35	75.40	16.07	-.175
22.....	80	29	.363	70.75	62.03	20.23	.417
30.....	46	9	.196	67.65	71.44	15.52	-.173
29.....	24	2	.083	66.79	66.00	13.03	.033

TABLE XIX

Biserial *r*'s of Withdrawal-Remaining  
and Clerical Interest Test Scores

College No.	N <sub>t</sub>	N <sub>w</sub>	p <sub>w</sub>	M <sub>t</sub>	M <sub>w</sub>	S.D.	r <sub>bi</sub>
24.....	92	21	.228	46.50	52.10	13.31	-.318
21.....	89	29	.326	49.00	52.52	14.57	-.219
39.....	35	12	.343	53.85	51.00	13.15	.202
11.....	92	12	.130	53.60	53.17	13.87	.019
25.....	54	10	.185	54.30	56.50	13.77	-.111
22.....	80	29	.363	42.68	43.66	14.74	-.064
30.....	46	9	.196	57.75	52.67	12.94	.279
29.....	24	2	.083	49.70	51.00	10.90	-.065

Appendix B

Mean Scoring Weights for Alternatives  
of Personal Data Blank

- |      |   |      |   |
|------|---|------|---|
| 1.   | <b>For how long have you been intending to become a pharmacist?</b> | 4.25 | For more than one month but less than six months  |
| 3.59 | Less than three months  | 4.22 | For more than six months but less than one year   |
| 4.34 | Between three and six months  | 4.22 | For more than a year  |
| 3.84 | Between six and twelve months                                       | 3.   | <b>Which one of the following statements best expresses your attitude towards pharmacy as a profession for you?</b> |
| 4.09 | Between twelve months and two years                                 | 3.78 | This is the ideal vocation for a life work  |
| 3.91 | More than two years   | 4.22 | There are only a few vocations I would rather have than this one  |
| 2.   | <b>For how long have you worked in a pharmacy?</b>                  | 4.19 | I can think of a lot more   |
| 3.66 | Have never worked in a pharmacy                                     |      |   |
| 3.84 | For less than one month   |      |   |

- advantages than disadvantages in this work 4.00 a small town (1,000 to 10,000) 4
- 4.00 My likes and dislikes for this work about balance one another 3.81 a village (under 1,000) 3
- 3.94 To me this vocation is more or less boring 3.81 the country 3
4. **What will be the main source of financial support for your college education?** 8. **Have you ever been registered as an apprentice pharmacist?** 1
- 3.88 Mainly from parents or relatives 4.03 Yes 4
- 4.00 Mainly from my own earnings while in college 3.13 No 3
- 3.75 Mainly from my own savings in the past 9. **What is your parents' approximate annual income?** 1
- 4.13 Mainly from the GI Bill (Public Law 346) 4.09 \$2,000 or less
- 3.62 Mainly from a veteran's pension and Public Law 16 3.81 Between \$2,000 and \$3,000
5. **How many times did you attend a summer camp between the ages of 5 and 18?** 4.13 Between \$3,000 and \$4,000
- 3.88 Never 4.00 Between \$4,000 and \$5,000
- 3.88 One summer 4.09 More than \$5,000
- 4.09 Two summers 10. **How many dependents do you have?** 3
- 4.28 Three summers 3.78 None 3
- 4.19 Four or more summers 4.22 One 4
6. **The number of books in your parents' home is best estimated as** 4.03 Two 4
- 3.91 a whole room full—a library 3.94 Three 1
- 4.13 two or more book-cases full 3.84 Four or more
- 3.94 one book-case full 11. **What is your marital status?** 2
- 3.96 a few—not more than 25 3.75 Single to
- 3.91 none, or not more than 5 4.22 Married ch
7. **During most of your life has your home been in** 4.00 Widowed th
- 4.38 a large city (100,000 or more) 4.03 Divorced
- 4.03 a small city (10,000 to 100,000) 4.03 Separated
12. **Has any close relative of yours ever graduated from a college of pharmacy?** 21
- 3.94 Yes, my father (or mother)
- 4.22 Yes, my brother (or sister)
- 4.09 Yes, my uncle (or aunt)
- 4.03 Yes, my first cousin 22
- 3.84 None of the above
13. **How old were you, to your nearest birthday, when you graduated from high school?** 23
- 4.25 16 or younger



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- |  |   |
|--|---|
| 4.00 17  | 3.78 Yes  |
| 4.06 18  | 4.22 No   |
| 3.56 19  |   |
| 3.69 20 or older   | 17. Do your parents own a vacuum cleaner?   |
| 14. Are you a transfer student?  | 4.06 Yes  |
| That is, have you come to your present college after earning some credits at another college?  | 4.03 No   |
| 4.03 Yes   | 18. Does your parents' home have central heating (furnace heat)?  |
| 3.69 No  | 3.94 Yes  |
|  | 4.09 No   |
| 15. Have you at present credits for any college courses earned in your present college or in another college? (Credits=semester-hours) | 19. Do your parents own an electric or gas refrigerator?  |
| 3.91 No  | 3.78 Yes  |
| 3.88 Yes, 0-6 credits  | 4.09 No   |
| 4.03 Yes, 7-12 credits   | 20. Have you ever had paid lessons in dancing, dramatics, expression, elocution, art, or music outside of school? |
| 3.97 Yes, 13-18 credits  |   |
| 4.25 Yes, 19 or more credits   |   |
| 16. Do your parents own an automobile?   | 3.97 Yes  |
|  | 3.94 No   |

21-29. It is possible to make a rough classification of occupation in terms of the kinds of interests involved. Listed below are nine such classifications. Indicate the degree of your liking for each by marking the space on the answer sheet numbered.

- |                                    |                            |
|------------------------------------|----------------------------|
| 1—if you dislike it very much      | 4—if you like it mildly    |
| 2—if you dislike it mildly         | 5—if you like it very much |
| 3—if you are indifferent toward it |                            |

- |  | MEAN SCORING WEIGHTS |      |      |      |      |
|--|----------------------|------|------|------|------|
|  | 1                    | 2    | 3    | 4    | 5    |
| 21. <b>Mechanical</b> —such as mechanical engineer, inventor, surgeon, blacksmith, cabinetmaker, compositor, mechanic, etc. .... | 4.03                 | 3.81 | 4.06 | 4.16 | 3.75 |
| 22. <b>Computational</b> —such as accountant, actuary, mathematician, calculating machine operator, etc. ....                    | 3.97                 | 4.06 | 3.91 | 4.03 | 4.25 |
| 23. <b>Scientific</b> —such as archeologist, bacteriologist, engineer, geologist, meteorologist, agronomist, etc. ....           | 4.00                 | 3.63 | 3.94 | 3.94 | 4.13 |

		MEAN SCORING WEIGHTS				
		1	2	3	4	5
24.	<b>Persuasive</b> —such as salesman, advertising manager, foreman, lawyer, coach, hotel manager, etc. ....	4.06	3.91	4.19	3.94	4.00
25.	<b>Artistic</b> —such as costume designer, furniture designer, window dresser, art teacher, sculptor, etc. ....	3.91	4.00	4.09	4.06	4.22
26.	<b>Literary</b> —such as copywriter, editor, writer, journalist, lawyer, librarian, etc. ....	4.09	4.06	4.03	3.97	4.16
27.	<b>Musical</b> —such as composer, music arranger, music critic, music teacher, musician, singer, etc. ....	3.91	3.91	4.03	4.28	3.94
28.	<b>Social service</b> —such as camp director, recreation director, social worker, counselor, dean, YMCA director, etc. ....	4.09	4.19	4.28	3.88	3.69
29.	<b>Clerical</b> —such as auditor, bookkeeper, secretary, stenographer, correspondence clerk, billing clerk, etc. ....	4.16	4.28	3.97	3.91	3.84
30-55. For each of the community or high school extracurricular activities listed below, indicate the way in which you have participated by marking the space on the answer sheet numbered						
1—if you did not participate in it at all						
2—if you participated, but only as a member						
3—if you participated as an officer, captain, or leader, etc.						
geologist, meteorologist,						
agronomist, etc. ....						
		4.00	3.63	3.94	3.94	4.13

		Mean Scoring Weights		
		1	2	3
30.	Band .....	3.44	4.41	4.41
31.	Orchestra .....	3.63	4.13	4.07
32.	Glee club .....	4.22	3.88	4.06
33.	Debate .....	3.91	4.05	4.19
34.	Oratory .....	4.00	4.00	4.09
35.	Plays or dramatics .....	3.88	3.97	3.97
36.	School paper editorial staff .....	3.88	4.09	4.09
37.	School paper business staff .....	3.97	4.03	4.25
38.	Year book editorial staff .....	3.88	4.03	4.09
39.	Year book business staff .....	4.16	3.84	4.19
40.	Intramural football .....	3.91	3.94	4.13
41.	Extramural football .....	3.81	3.97	3.94
42.	Intramural basketball .....	3.75	4.13	3.94
43.	Extramural basketball .....	4.00	4.03	4.00
44.	Intramural baseball .....	3.94	4.03	3.91
45.	Extramural baseball .....	3.97	3.97	4.00
46.	Other sports—intramural .....	4.03	4.00	4.13
47.	Other sports—extramural .....	3.97	4.00	4.13
48.	Honor society .....	3.59	4.41	4.31
49.	Class organization .....	3.84	3.94	4.16
50.	Hi-Y .....	3.78	3.78	4.13
51.	Hobby clubs .....	3.78	4.19	4.16
52.	Church organizations .....	4.00	3.88	4.19
53.	4-H Club .....	3.94	4.09	3.63
54.	Boy or Girl Scouts .....	4.03	3.88	4.28
55.	Fraternity or sorority .....	3.72	4.31	4.16

*Appendix C*

## Inquiry Concerning Student Personnel Procedures in Colleges of Pharmacy

Date \_\_\_\_\_

Name of Institution \_\_\_\_\_

If any of the following items require further explanation please attach the explanation on a separate sheet, referring to the item by number.

### I. ADMISSION PROCEDURES

- A. Which of the following types of data are used as the bases for determining admission to the college of pharmacy?

How often used (Check % of  
applicants required to furnish  
such data)

	50- 100%	10- 99%	0- 49%	0- 9%	Remarks on how used
1. Rank in high school class					
2. Coll. Ent. Exam. Board ratings					
3. Subject-matter (achievement) examinations by your institu- tion					
4. Other examinations such as Regents or state-wide tests (Specify)					
5. Intelligence or aptitude tests (Specify)					
6. Personal interview					
7. Biographical data (Attach blank)					
8. Interest or attitude tests					
9. Personality ratings					
10. Health record					
11. Others (Describe)					

**B. Who performs the admissions functions? (Please check)**

1. Director of Admissions .....
2. Registrar .....
3. Dean of Pharmacy .....
4. Other officer (specify) .....

**C. What form of high school accreditation is required?**

1. None .....
2. Regional accrediting agency (specify) .....
3. National accrediting agency (specify) .....

**D. What high school subjects, if any, are required for admission?**

Subject	Fill in no. of high school units required
1. English	.....
2. Mathematics	.....
3. General science	.....
4. Physics	.....
5. Chemistry	.....
6. Biology	.....
7. Social studies	.....
8. Foreign (ancient or modern) languages	.....
9. Others	.....
10. ....	.....

**E. What requirements or restrictions are placed on the admission of transfer students? (Fill in)**

1. Number of credits transferable? .....
2. Kinds of credits transferable? .....
3. Quality of grades transferable? .....
4. Others .....

**F. Admissions application blank. (Please attach one copy of your blank)**

## II. GUIDANCE AND COUNSELING PROCEDURES

- A. Personal records. Which of the following types of records are kept concerning students? (Please check)

	% of Students for Whom Kept				Class of Students for Whom Kept			
	100%	50-99%	10-49%	0-9%	Fr.	Soph.	Jr.	Sr.
1. Academic (instructors' grades)								
2. Intelligence test scores								
3. Special ability test scores								
4. Interest test scores								
5. Health and physical records								
6. Interview records								
7. Rating scale records								
8. Anecdotal records								
9. Others .....								

- B. Who keeps and maintains the various records concerning students? (Please fill in)

## Types of records kept

- Admissions office: .....
- Registrar: .....
- Dean of College of Pharmacy: .....
- Instructors: .....
- Testing bureau: .....
- Counseling bureau: .....
- Other offices (Specify): .....

- C. Orientation procedures. What are the procedures for orienting new students and the college to each other?

- Orientation testing: What tests, if any, are given to **all** or **most** new students in the college of pharmacy? (Specify)

.....

.....

.....

- What lectures, other activities, reading materials, etc., are provided for new students? (Specify any how-to-study cour-



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ses, occupational information resources, conferences, group guidance work, tours, etc.)

.....  
.....  
.....  
.....

D. Individual counseling procedures and facilities.

1. What kinds of personnel are officially designated as responsible for student counseling on educational, vocational, and personal adjustment? (Give number of persons and description of qualifications.)

a. Professionally trained full-time counselors?

.....

b. Professionally trained part-time counselors?

.....

c. Instructional staff (faculty advisers) with counseling duties?

.....

d. Student counselors? .....

.....

e. Others (Specify) .....

.....

2. What requirements are placed on students for their use of counseling facilities?

a. All students required to use some counseling facility.  
(Specify requirement)

.....

b. Some students required to use some counseling facility  
(Specify requirement)

.....

c. No students required; all use of counseling facilities  
is on a voluntary basis. (If possible describe extent of  
use)

.....

.....

3. What tests are used in counseling procedures?

a. None .....

b. The following tests of special abilities, interests, personal  
adjustment, etc. (Names of tests) .....

.....

.....

.....

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4. What interview procedures are used in counseling individual students? (Encircle A for Always, Of for Often, Oc for Occasionally, S for Seldom, N for Never.)

- |  |       |    |    |   |   |
|--|-------|----|----|---|---|
| a. Interviews are limited to a specified duration                | A     | Of | Oc | S | N |
| b. Interviews are recorded in written form                       | A     | Of | Oc | S | N |
| c. Interviews are held in a private office                       | A     | Of | Oc | S | N |
| d. Others. (Describe other interviewing policies and procedures) | _____ |    |    |   |   |

- E. Special services. Which of the following special services are available to your students? (Describe each briefly in terms of staff, facilities, etc.)

1. Speech clinic \_\_\_\_\_
2. Reading clinic \_\_\_\_\_
3. Psychological clinic \_\_\_\_\_
4. Psychiatric services \_\_\_\_\_
5. Part-time employment office \_\_\_\_\_
6. Alumni placement office \_\_\_\_\_

- F. Published materials. List below the titles of published materials describing and/or evaluating the student personnel program for students in your school of pharmacy. Please furnish the Pharmaceutical Survey with as many of these publications as possible. Check the publications being furnished.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Signature \_\_\_\_\_

Official Position \_\_\_\_\_

Appendix D

# Tables Related to "Inquiry Concerning Student Personnel Procedures in Colleges of Pharmacy"

**TABLE XX**

Percentages of Colleges Using Various Types of Data for Determining Admissions

Type of Data	How Often Used (% of Applicants Required To Furnish Such Data)				Answer Omitted
	100%	50-99%	10-49%	0-9%	
Rank in high school class .....	67	12		9	12
College Entrance Examination Board ratings .....			12	27	61
Subject matter (achievement) examinations by your institution .....	18		9	28	45
Other examinations such as Regents or state-wide tests .....	13	6		22	59
Intelligence or aptitude tests .....	47	9	12	12	20
Personal interview .....	30	24	18	10	18
Biographical data .....	72				28
Interest or attitude tests .....	21		6	18	55
Personality ratings .....	18	6	9	12	55
Health record .....	61	6		3	30
Others .....	12	6	3	6	73

**TABLE XXI**

Percentages of Colleges of Pharmacy in Which Various Officers Perform Admissions Functions

Officer	Percent*
Director of admissions .....	32
Registrar .....	47
Dean of pharmacy .....	62
Other officers .....	35

\*Percentages total more than 100 percent because some colleges have more than one officer performing admissions functions.

**TABLE XXII**

Percentages of Colleges of Pharmacy Which Require  
Various Types of High School Accreditation  
as a Basis for Admissions

Form of High School Accreditation	Percent*
None .....	6
Regional accrediting agency .....	44
National accrediting agency .....	3
State accreditation .....	65

\*Percentages total more than 100 percent because some colleges require or accept more than one form of high school accreditation.

**TABLE XXIII**

Percentages of Colleges of Pharmacy Requiring Various  
Numbers of High School Units for Admission

Subjects	Number of High School Units Required				
	1	2	3	4	5 or More
English .....			48	36	
Mathematics .....	12	64	21		
General science .....	3				
Physics .....	6				
Chemistry .....	3				
Biology .....	3				
Social Studies .....	36	24	3		
Foreign (ancient or modern) languages .....	3	12	3		
Others .....	3			12	27
High school gradu- ation according to state requirements .....				6	
Any laboratory science plus math- ematics .....					3
General science or Physics .....	3				
Any laboratory science .....	18	3			
Any science .....	15	9			

**TABLE XXIV**

Percentages of Colleges of Pharmacy Placing Certain Restrictions on the Admission of Transfer Students\*

	Not More Than 1 Yr.	Not More Than 2 Yrs.	Not More Than 3 Yrs.
1. Number of credits transferable			
From colleges of pharmacy .....			47%
From other colleges .....	47%		
No source specified .....	6%		
2. Kind of credits transferable			
Liberal arts and science subjects: 6%			
Subjects specified in own curriculum: 68%			
3. Quality of credits transferable			
D or above: 6%			
C or above: 76%			
B or above: 3%			
B-, or better, average: 3%			

\*Percentages do not total 100 because some institutions did not furnish information on this subject.

**TABLE XXV**

Percentages of Colleges of Pharmacy Keeping Certain Records on Various Proportions of Their Students

Type of Record	Percentage of Students for Whom Records Kept				
	100%	50-99%	10-49%	0-9%	No answer
Intelligence test scores .....	68	12			20
Special ability test scores .....	38	3		6	53
Interest test scores .....	15	6		9	71
Health and physical records .....	77	10		3	20
Interview records .....	26	15	6	9	44
Rating scale records .....	21	3	3	3	70
Anecdotal records .....	9	6	6	6	74
Others .....	6	3		3	85

**TABLE XXVI**

Percentages of Colleges of Pharmacy Giving Various  
Numbers of Tests to All or Most New Students

Number of Tests Given	Percentage of Colleges
4 or more .....	38
3 .....	6
2 .....	0
1 .....	3
0 .....	32
No answer .....	21
	<hr/> 100

**TABLE XXVII**

Percentages of Colleges of Pharmacy Providing Various  
Orientation Activities for New Students

Orientation Activity	Percentage of Colleges*
Group guidance and lectures .....	56
Campus, building, and other tours .....	35
How-to-study lectures, courses, etc. ....	35
Conference with dean .....	29
Schedule help, conference with adviser ..	24
Freshman handbook .....	18
How-to-use-library instruction .....	12
Tutorial service for deficient students ..	12
Meeting with student leaders .....	3
Films .....	3
Orientation course .....	3
None .....	12

\*Percentages total more than 100 because some colleges listed more than one activity.

**TABLE XXVIII**

Percentages of Colleges of Pharmacy Having Certain  
Kinds of Personnel Officially Designated as  
Responsible for Student Counseling

Kind of Personnel	Percentage of Colleges
Professionally trained full-time counselors .....	68
Professionally trained part-time counselors .....	24
Instructional staff with counseling duties .....	85
Students who do counseling .....	3



**TABLE XXIX**

Percentages of Colleges of Pharmacy Placing Certain  
Requirements on Students for Their Use of  
Counseling Facilities

Requirement	Percentage of Colleges
All students required (e. g., for scheduling and curricular problems) .....	26
Some students required (e. g., those with scholastic difficulties) .....	38
Voluntary basis for use of counseling (e. g., those whose ability or interest is suspect) .....	35

**TABLE XXX**

Percentages of Colleges of Pharmacy Using Certain Types  
of Tests in Their Counseling Procedures

Type of Test Used	Percentage of Colleges
Scholastic aptitudes (general) .....	21
Interest .....	24
Special abilities or aptitudes .....	15
Adjustment or personality .....	15
Veterans Administration approved tests .....	9
Science .....	9
English .....	9
Reading .....	9
Mathematics .....	9
Social Studies .....	9
No tests .....	29
"Many" tests .....	9

**TABLE XXXI**

Percentages of Colleges of Pharmacy Using Certain  
Interview Procedures in Counseling Students

Procedure	How Often Used-Percent				
	A*	Of*	Oc*	S*	N*
Interviews limited to specified duration .....		6	3	9	47
Interviews recorded in written form .....	24	15	26	3	6
Interviews held in private office .....	76	9			
Other procedures .....		26			

\*Always, Often, Occasionally, Sometimes, Never.

**TABLE XXXII**

Percentages of Colleges of Pharmacy Providing Certain  
Special Services to Students

Special Service	Percentage of Colleges
Speech clinic .....	44
Reading clinic .....	32
Psychological clinic .....	56
Psychiatric service .....	44
Part-time employment office .....	97
Alumni placement office .....	74

*Appendix E*

Colleges of Pharmacy that Furnished  
Data for the Inquiry Concerning  
Student Personnel Procedures

Alabama Polytechnic Institute	University of New Mexico
Howard College	Albany College of Pharmacy
University of Southern California	Fordham University
University of Connecticut	Brooklyn College of Pharmacy, L.I.U.
George Washington University	University of Buffalo
Purdue University	Columbia University
University of Kansas	University of North Carolina
Loyola University	North Dakota Agricultural College
University of Maryland	Cincinnati College of Pharmacy
Massachusetts College of Pharmacy	Ohio State University
University of Minnesota	Oregon State College
University of Mississippi	Philadelphia College of Pharmacy
University of Kansas City	Duquesne University
St. Louis College of Pharmacy	University of Pittsburgh
Montana State University	South Dakota State College
Creighton University	University of Washington

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*Appendix F*

Memorandum on Achievement Testing,  
August 26, 1946

The Achievement Testing Program of the Pharmaceutical Survey has as its general objective the development of a set of measuring devices that will yield a maximally valid ranking of pharmacy students with respect to their achievement in training. As the first major step toward this goal, it is planned that four com-

prehensive examinations will be constructed in each of the four major fields of pharmaceutical education. The objectives at the achievement of which these comprehensive tests will aim will be restricted to those that can be evaluated by means of printed, paper-and-pencil, short-answer, machine-scorable tests. The achievement of objectives other than these may eventually be evaluated by means of performance tests, interviews, and other techniques in so far as time and other resources of the Pharmaceutical Survey may make such a program possible.

The following suggestions are designed to make it possible for this work of the Pharmaceutical Survey to proceed with maximum efficiency and dispatch. In order that the subject-matter experts responsible for prescribing the content of the comprehensive achievement tests may proceed in the light of experience gained in other test construction programs, it is suggested that they undertake, if they have not already done so, to become familiar with the general procedures and rationale of test construction. For this purpose the following references are recommended:

H. H. Remmers and K. S. Davenport, "Objective Testing at the University Level," Mimeographed; Purdue University, Lafayette, Indiana, December 1944.

H. H. Remmers and N. L. Gage, **Educational Measurement and Evaluation** (New York: Harper & Bros.), chaps. ii, vii, and ix.

H. E. Hawkes, E. F. Lindquist, and C. R. Mann, **The Construction and Use of Achievement Examinations** (New York: Houghton Mifflin Co., 1936).

In addition to the materials contained in these references, the following constitutes a set of guides specifically intended for the work of achievement test authors in the Pharmaceutical Survey:

1. The subcommittee of three responsible for each of the four major areas of pharmaceutical education will bear the general responsibility for insuring the validity of the content of the tests constructed by it.

2. Each subcommittee should prepare a detailed outline of the objectives of instruction and training in that branch of the pharmaceutical curriculum with which it is concerned. This outline of objectives will be prepared in standard outline form, proceeding from the general to the specific within each subhead.

3. The members of the subcommittee will assign to each general and specific objective a weighting in terms of a total possible weighting of 100 percent; that is, each specific objective will finally be assigned a percentage indicating its importance to the total achievement of the pharmacy student in that branch of the pharmaceutical curriculum. Those objectives that are not amenable to printed, short-answer testing should be assigned no weights, but should be included in the outline.

4. As soon as the subcommittee has reached a preliminary agreement upon the outline and weighting of the objectives of instruction, they can begin to construct short-answer test items aimed at the achievement of those objectives. This work can begin before final approval has been placed upon the statement and weighting of the objectives.

5. The weighted outline of instructional objectives will be submitted to other authorities in the particular branch of the pharmaceutical curriculum. Any suggestions and recommendations made by these experts will be taken into account by the subcommittee before the final draft of the statement and weighting of objectives is formulated.

6. In the construction of short-answer tests items members of the subcommittee should secure guidance from the references listed above. In general, the items should be in such form that the answers will be machine-scorable throughout, unless special dispensation has been obtained from the central office to provide for experimentation with some other type of item which seems likely to result in considerably higher validity for a given type of instructional objective. In general, items with five alternative answers should be employed, with only one correct alternative.

7. In general, the test prepared by each subcommittee should be of such length that about 90-95 percent of the students will complete it in a three-hour period. This will probably mean that the test will contain somewhere between 150 and 300 items. Other things being equal, the more items, that is, the greater the number of discrete and independent units of student achievement that can be elicited, the more reliable will be the test. This implies that any exercises so complex and time-consuming that only 10 to 30 of them can be worked per hour should be avoided. Rather, the test authors should analyze such complex and highly time-consuming types of exercises, identify the most crucial steps of the reasoning involved in their solutions, and construct more specific exercises concerned only with these crucial steps. In this way, the complex

achievement can be broken down into relatively short problems, larger in number, and yielding a more reliable, but equally valid, record of the student's achievement.

8. Each item should be independent of the others in the sense that its correct solution must not depend upon a correct solution to preceding items. Interdependent problems or items reduce the reliability of tests, since students tend to pass or fail them as a unit, or as if they constituted only one long problem.

9. In exercises where the student will be required to compute an exact numerical answer to a set problem, it may be desirable to use as the fifth alternative "None of the above answers is correct" or the equivalent. Otherwise, if the student gets a wrong answer not like any of the answers given, he may know he has erred and may try again until he reaches the correct answer by trial and error, or he may resort to guessing. The use of the "none correct" alternative also keeps the student from wasting time on problems he cannot solve and gives results more like those obtained from free-response exercises.

10. In general, as much emphasis as possible should be placed on items that get at the "higher mental processes" as they operate in the pharmaceutical curriculum. That is, the ability to interpret, to apply principles, to solve actual problems as they arise in professional practice or in research, should often be involved in the questions rather than mere ability to recognize correct statements of facts.

11. Each comprehensive test will go through the steps listed on the attached flow sheet.

**FLOW SHEET**

**Pharmaceutical Survey Achievement Testing Program**

Operation	Dates for Each Curricular Area			
	Pharmacy	Pharmacognosy	Pharmacology	Pharmaceutical Chemistry
1. Statement* received in central office** from subcommittee***				
2. Statement edited and sent to consultant experts****				
3. Statement received in central office from consultant experts				
4. Statement returned to subcommittee from central office				
5. Statement revised by subcommittee and final form received at central office				
6. First draft of test received in central office*****				
7. Edited first draft returned to subcommittee				
8. Revisions and further editing of test by subcommittee and submission of semifinal draft to central office				
9. Semifinal draft of test sent to consultant experts				
10. Semifinal draft of test received in central office from consultant experts				
11. Semifinal draft of test returned to subcommittee with criticisms from consultant experts				
12. Final draft of test received in central office from subcommittee				
13. Mimeo stencil cut, proofread, and sent to subcommittee				
14. Final mimeo stencil received in central office from subcommittee				
15. Printing completed				
16. Arrangements for administration completed				

\***Statement**—The statement of weighted instructional objectives with the achievement of which the test is to be concerned.

\*\***Central Office**—The Pharmaceutical Survey, Student Personnel Studies, Division of Educational Reference, Purdue University, Lafayette, Ind.

\*\*\***Subcommittee**—The group of three subject-matter experts who have responsibility for the construction of the achievement test in the given field of the pharmaceutical curriculum.

\*\*\*\***Consultant Experts**—Other experts in the subject matter and in test technology to whom preliminary drafts of the statements and the tests will be sent for criticism.

\*\*\*\*\*Work on first draft of test items can be begun before or concurrently with steps 2-5.



**Rules of Style and Format To Be Used in Writing Test Items  
for the Pharmaceutical Survey Achievement Testing Program**

The purpose of these rules is to establish, somewhat arbitrarily, a set of conventions that will result in uniformity in the appearance of tests, clarity in the phrasing and punctuation of questions, ease and accuracy on the part of the student in putting his answers on a separate sheet, and minimum labor on the part of authors and editors in reducing the copy of the various authors to a single format.

1. Test items should all be written as multiple-choice items. These consist of an introductory part, either an incomplete statement or a question, and of several alternatives, of which only one is considered correct.

2. Many workers consider the direct question form preferable on the ground that it is more easily phrased, more natural, less likely to be ambiguous, and less likely to contain irrelevant clues to the correct answer. On the other hand, this form is likely to be slightly longer and to require more words than the equivalent incomplete-statement form.

3. If the introductory incomplete-statement form is used, it should be meaningful in itself and imply a direct question rather than merely lead into a collection of unrelated true-false statements. That is, the introductory statement should usually consist of both a subject and a predicate that state the central theme or idea of the question.

4. The incorrect alternatives should be plausible so that uninformed or unknowing students will tend to select them rather than the correct alternative. Plausibility may be attained by making the incorrect alternatives, or distractors, as familiar as the correct one, related to the same concepts, and, as far as possible, as reasonable and natural as the correct alternative.

5. The length of the alternatives—the number of words each contains—should not vary systematically with the correctness of the alternative. Test technicians often notice a tendency on the part of test authors to make the correct alternative longer than the incorrect ones.

6. The alternatives should come at the end of the statement if the incomplete-statement form of introduction, or stem, is used. If space permits, the alternatives should be listed one under the

other rather than be placed in a paragraph, because listed alternatives are easier to read and consider separately.

7. Grammatical consistency should be maintained throughout the item. It should be possible to form a correct sentence by attaching any of the alternatives to the introductory incomplete statement.

8. The number of alternatives should be at least four or five if possible. The number should, however, be reduced below this if it is impossible to construct alternatives to this number without involving absurdities or obviously false distractors.

9. Wherever the student must compute an exact quantitative answer to a given question, as in questions involving mathematical computation, it is generally worth while to make the fifth alternative read "None of the above answers is correct" or the equivalent of this.

10. In preliminary work on the test questions, it is suggested that each item be placed on a separate card or sheet of paper so that the work of sorting, editing, arranging them in the desired order of difficulty, etc., may proceed most efficiently.

11. Each alternative in multiple-choice items should be numbered 1, 2, 3, 4, 5 rather than lettered a, b, c, d, e. In the final form of the test, when each question has been numbered, the alternatives will be designated by the number of the question, a hyphen, and then the number of the alternative. For example, the third alternative in question 23 will then be numbered 23-3. This practice may make it easier for students to find the correct space on their answer sheet for the alternative they have chosen.

12. Introductory incomplete statements in multiple-choice items should not end in a colon, a dash, or any other punctuation.

13. Alternatives following incomplete introductory statements in multiple-choice items should not begin with a capital letter. Alternatives following complete questions or complete statements should begin with a capital letter.

14. Alternatives should be followed by a period only if they are themselves complete statements or if they complete a statement begun in the introduction to the question.

15. Wherever the answer to a question depends upon a single crucial word or phrase, the question can be prevented from becoming a trick or catch question if this crucial word or phrase is underlined so that the student's attention will be called to it.

16. Each item or question should be keyed to a specific part of the outline of instructional objectives. In this way it becomes easy to determine the instructional objectives at the achievement of which the question is aimed.

17. The correct answer to each question should be written in the lower right-hand corner of the card on which the question is placed.

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### *Appendix G*

## Instructions Regarding Routing in Construction of Senior Comprehensive Examinations of the Pharmaceutical Survey

In order to facilitate the work on the achievement examinations and especially to make sure that all questions go through the proper channels, it is recommended that the following routing scheme be followed for all questions constructed and submitted:

1. The subcommittee member will send two copies of his items to the chairman, meanwhile retaining a copy for his files.
2. The chairman of the subcommittee will send one copy of the questions to the central office (Dr. H. H. Remmers, Division of Educational Reference, Purdue University, Lafayette, Indiana).
3. The central office will send one copy of the questions to each of the three consultants for each committee, meanwhile sending its own criticisms to the chairman.
4. Consultants will send their criticized copies of the questions to the central office.

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5. The central office will forward the consultant's criticisms to the chairman.

6. The chairman will forward the criticisms to the appropriate subcommittee member.

This arrangement will clarify the procedure to be used by committee members, chairmen, and consultants in the forwarding of proposed achievement examination items.

Cordially yours,

H. H. Remmers, Director  
Student Personnel Studies

To the Members of the Subcommittees on Achievement  
Examinations in the Pharmaceutical Survey and to  
Consultant Experts

Dear Colleague:

At the risk of carrying coals to Newcastle, I wish to call your attention to a paper by Dr. Charles H. Rogers and Dr. Palmer O. Johnson, both of the University of Minnesota, entitled "Comprehensive Examinations in the College of Pharmacy at the University of Minnesota," **American Journal of Pharmaceutical Education**, VIII (January 1944), 5-26.

This paper is particularly valuable not only in that it contains a good brief discussion of the rationale of achievement examinations, but also in that it gives sample examination items which may prove useful for your guidance. Not all of these items, you will note, are in the multiple-choice form recommended in the "Memorandum on Achievement Examinations" which it is necessary to maintain in order to make possible the types of analyses planned for our examinations, as well as to obtain greater reliability than other types afford.

Cordially yours,

H. H. Remmers, Director  
Student Personnel Studies

*Appendix H*

## Directions for Administering Senior Comprehensive Examinations

1. **Use of examination scores.**—Students should be informed that their scores on these examinations will be filed in the permanent records of the Secretary of the National Association of Boards of Pharmacy in Chicago. Furthermore, to insure adequate motivation, it is recommended that the scores on these examinations be used in the actual grading of seniors and that the students be informed of this. This office will do everything in its power to return the scores to the schools in time for this purpose.

2. **Norms.**—Since this is the first nation-wide administration of these examinations, no national norms are available nor will they be available in time for interpreting the scores of the present senior classes on these examinations. It will, of course, be possible for each institution to use the test scores in evaluating the achievement of its own seniors by ranking its students.

3. **Time of examinations.**—The examinations should be given as close to the end of the semester as is feasible. Allowance should be made, if the scores on the examinations are to be used for grading senior students, for the time required for scoring these examinations at Purdue University and for typing and returning rosters of test scores to your institution. (They will be scored and rosters will be en route by air mail within twenty-four hours after their receipt.)

4. **Order of examinations.**—The examinations are to be given in the following order:

- 1st session: Pharmaceutical chemistry
- 2nd session: Pharmacognosy
- 3rd session: Pharmacy
- 4th session: Pharmacology

5. **Examination security.**—The examinations are to be kept under lock and key at all times when they are not in use. Each examination is to be strictly accounted for, and all copies of it are to be returned to the above address at the completion of the testing. It is essential to the continued usefulness of these examinations that

their security be completely preserved. For this reason each copy of each examination has been numbered and each institution is held responsible for the security and prompt return of all examinations allotted to it.

6. **Proctor.**—In addition to the staff member in charge of administering the examination, there should be at least one proctor for each thirty examinees in excess of thirty. This proctor will be needed to assist in distributing and collecting test materials, to answer questions on how the test is to be taken, to forestall cheating, and to insure security of the examinations.

7. **No rest periods.**—The time limit for each examination is three hours. This amount of time is to be given the student without interruption. Before distributing test materials notify the students that the examination is to last three hours and that there will be no rest period during this time. Students should be advised to visit rest rooms before the examination starts to avoid any discomfort while taking it. Only if absolutely necessary is a student to be allowed to leave the room while the examination is in progress. Such a student should be allowed as much extra time as he was away. Students who finish the examination before 180 minutes have elapsed may turn in their test materials and leave early, but only after they have blackened their answer sheets as instructed in paragraph 11.

8. **Student materials.**—Each student will need a test booklet for the given examination, a special IBM answer sheet, a special electrographic pencil, and one piece of scratch paper. (Additional scratch paper should be furnished as requested by the students.)

9. **Filling in answer sheets.**—The students should be instructed to fill in the information called for on the left-hand margin of the answer sheet. All the blanks should be filled in, except that after "Part." The space after "1. ...." should be filled in with the number stamped in the upper-right-hand corner of the cover of the student's test booklet.

10. **Starting the test.**—After the students have been seated and the materials have been distributed to them, the students should be told to fill out the answer sheet as directed above. Students should then be told to open the test booklet to page 2 and to read the directions silently while the examiner reads them aloud. These directions need be read aloud by the examiner only for pharmaceutical chemistry, the first examination of the series. For subsequent examinations, the students should be told to refer to these directions



on their own initiative to insure that they take the test properly. (A copy of page 2 is enclosed for use by the examiner.) After all questions have been answered concerning the test and how it is to be taken, the examiner should issue a last call for questions before the examination is started. After this last call the examiner should give the starting signal and make an exact record of the time at that moment.

**11. Stopping the test.**—Exactly 180 minutes after the starting signal has been given, the examiner should stop the students, instruct them to close and pass in their examination booklets. Students should then be instructed as follows:

"Go back over your answer sheet and blacken every answer you have made. Remember that your score will not be correct unless you have made heavy black marks and have erased all stray marks. You should have only one answer to each question on this test. Blacken every mark rather than relying on your judgment as to whether it is heavy enough because it has been found that visual inspection cannot discriminate marks that may be too light. You will have as much time as is necessary for you to blacken all marks."

When the last student has indicated that he has finished blackening his marks, collect the answer sheets and special pencils and announce the time and place of the next examination in the series. Then dismiss the students.



## The Organization of the Pharmacy Curriculum<sup>\*</sup>

EARL J. McGRATH

Dean, College of Liberal Arts  
The State University of Iowa.

The history of professional education in the United States shows a steady increase in the number of years of formal schooling required for admission to practice in the learned professions. In the early days of our history the prospective practitioner learned the arts and science of his future calling by serving an apprenticeship under a member of the guild to which he sought admission. In this capacity he learned the skills of practice by observation and imitation as he watched and assisted his mentor; the basic theoretic knowledge he acquired by reading the meager supply of scholarly literature. This informal and unorganized educational program produced most of the practitioners of the various professions until well after the middle of the nineteenth century.

All through the nineteenth century, however, vast quantities of new knowledge were being produced in the universities of this country and of Europe. Much of this new knowledge formed the scientific and scholarly basis of the work of the doctor, the dentist, the pharmacist, the lawyer, and other practitioners. In organic chemistry, for example, research workers produced a large body of scientific knowledge which illuminated problems in physiology and therapeutics. At the same time members of the various professions were organizing, classifying, and recording their professional experiences in

<sup>\*</sup> Dean McGrath represents the American Council on Education as a member of the American Council on Pharmaceutical Education. In recent years he has devoted much of his time to the study of the problem of the relation of liberal and professional education. His published works in this field are recognized as significant. At the request of Director E. C. Elliott of The Pharmaceutical Survey, Dean McGrath prepared this paper setting forth the elements of the problem of the broader education of the pharmacist. While this statement was prepared specifically for the consideration of the members of the Committee of The Pharmaceutical Survey, in view of the critical place of the pharmaceutical curriculum curriculum among the problems of pharmacy, it is certain that Dean McGrath's analysis and judgment deserve the greatest consideration by all engaged in the practice of pharmacy, and especially by that group dealing with pharmaceutical education.—Editor

scientific treatises and textbooks for the benefit of the next generation of practitioners who from these works could vicariously gain the principles and skills of practice.

As this two-pronged development progressed, the burden of passing on this basic knowledge and these practical skills became so great that the busy practitioner could no longer serve as a teacher of novices. Hence the members of the professions delegated this responsibility to formal teaching bodies. These agencies, in the beginning often proprietary organizations, later became part of institutions of higher education, and professional courses of study embodying both theory and practice were permanently established. At first these courses of study were narrow in scope and brief in duration. In 1875, for example, the curriculum in the average college of medicine did not embrace more than two years of study of six months each. In other professions even less time was spent in preparation for practice. When measured by present standards the amount of professional subject matter was limited, and the amount of general education required for admission to the professional schools was represented by no more than the high school curriculum. As late as 1910 when Flexner reported on medical education, the majority of medical students had had no previous education beyond that offered in the secondary school. The rapid extension of the premedical courses of study since that time has been paralleled though not duplicated in dentistry and law.

There is now a widespread desire among educators in all branches of learning to increase the general knowledge of American youth regardless of their future vocation. Some of the strongest and most vocal leadership in this movement to improve the education of this generation for the responsibilities of citizenship in an increasingly complex world comes from educators in the professions. Some professions like pharmacy, engineering, education, and nursing, which hitherto have admitted students directly from the high school without any prerequisite college studies are now seriously considering an increase in the length of the curriculum to provide more such instruction. Since existing courses of study leading to membership in the learned professions are already considered ex-

cessively long by many educators, and laymen as well, the reasons for adding further general requirements in a professional program may well be questioned.

Those who advocate an extension and improvement of the general education component in professional curricula are moved by three considerations. In the first place, they see the present crisis in world affairs. They observe our inability to cope with complex domestic and international problems which we must as a nation deal with intelligently or suffer continuous unrest and frustration. In the activities of life which call for specialized knowledge and training, in the making of supersonic airplanes, in the building of skyscrapers, in the production of millions of vitamin tablets, in doing these things through science and technology we have been preeminently successful. In the management of our lives and in our relations with our neighbors at home and abroad we have gained little in wisdom, if the results are to be measured in terms of a better organization of our social institutions for human betterment and happiness. In providing the means of the good life our education has been highly successful; in identifying and in achieving the ends of the good life it has been lamentably ineffective. As Chancellor Hutchins put it, "The great problem of our time is moral, intellectual, and spiritual. With a superfluity of goods we are sinking into poverty. With a multitude of gadgets we are no happier than we were before. With a declining death rate we have yet to discover what to do with our lives. With a hatred of war we are now deeply engaged in the greatest war in history. With a love of liberty we see much of the world in chains."

The current interest in general education among professional groups like the pharmacists is an acknowledgment that higher education must not only prepare men and women for the peculiar activities of their own vocational group, but that it must also prepare them for the other activities which they have in common with their countrymen in all walks of life. If this educational goal is to be reached, the present courses of study must be augmented by units of nonprofessional subject matter.

But another reason for extending general education lies closer to the interests and needs of the members of the professions themselves. Contemporary professional education must rest on an increasingly broad base of general knowledge. The doctor, lawyer, and pharmacist of today must bring to his work a range of information far beyond that required for successful practice even twenty-five years ago. Through the activities of the graduate schools, and private and governmental research agencies, knowledge continues to grow at an ever increasing rate. Much of the knowledge thus produced is of a highly specialized nature which can best be learned after a specialty has been chosen. A considerable proportion, however, is fundamental knowledge underlying the entire professional field and hence must be known by all who intend to be more than mere technicians. The present efforts to expand the curriculum represent an acknowledgment that the fields of knowledge and the range of subject matter considered basic to the successful practice of pharmacy is now vastly greater than it was a quarter century ago.

There is yet another reason for broadening the base of professional education. It is now generally recognized, especially in the professions which have had a preprofessional requirement for many years, that the person with the most highly specialized education is not necessarily the most competent practitioner, to say nothing of his preparation for the activities of life beyond working hours. The medical schools which formerly advocated a high degree of concentration in science for premedical students now urge as broad a premedical education as possible in the various fields of knowledge. This policy rests upon careful studies which show that those who elect a large proportion of their premedical courses from among the sciences do no better in the medical school, other things being equal, than do students who major in English or history. Moreover, those who achieve distinction in their profession are usually men or women of broad interest and understanding, capacities which have traditionally been thought to develop

from the study of the varied disciplines embraced in the liberal arts.\*\*

For all these reasons professional groups have urged an increase in the amount of general or liberal education in the curricula which prepare practitioners both for their duties as members of a learned profession and as citizens.

The continuous extension of general education in recent years has been paralleled by an increase in the amount of specialized subject matter the future members of a professional group are expected to learn. As the quantity of both types of subject matter has increased, the question has naturally arisen as to whether the student should complete his general education before entering upon professional study, or whether both should proceed simultaneously. In several professions, medicine, dentistry, and law, for example, this question has been answered. The general or liberal studies precede professional studies, indeed, are often pursued in entirely different institutions.

In several other professions like pharmacy, engineering, and nursing, where the pressure for an extension of the curriculum has only recently become strong, educators are debating whether a one or two year preprofessional requirement should be established or whether the professional curriculum itself should be proportionately extended. Under the latter plan a single professional curriculum would include both technical and nontechnical subject matter. Part of this instruction, such as that in English, physics and mathematics, might be offered in a college of liberal arts, but would nonetheless be considered an integral part of the professional course of study.

Since the schools of pharmacy are now considering the adoption of one or the other of these curricular arrangements, a discussion of their respective merits is timely. The adminis-

\*\*William T. Foster, *Administration of the College Curriculum* (Boston: Houghton Mifflin Co., 1911), pp 222-232.

Earl J. McGrath, "What Subjects Should Pre-Medical Students Study?" *Journal of the Association of American Medical Colleges*, XX (September 1945), 273-80.



trative advantages in a preprofessional requirement embodying general studies and instruction basic to professional study are obvious. This arrangement leaves the curriculum of the professional school to be concerned primarily, if not exclusively, with technical material. It reduces or eliminates many complex relationships between faculties which provide general and those which offer professional studies. In universities with a number of professional schools, this plan makes possible the herding together of all students irrespective of their future calling in a common program of general or liberal education. During this period of the student's education his attention is focused exclusively upon the studies which prepare him for the activities of life which he has in common with all his fellow men.

Where the preprofessional requirement does not exceed two years, this plan has the additional advantage of permitting the student to attend a junior or community college in his own town. Informed opinion indicates that if the hundreds of thousands who will seek post high school education in the coming years are to be served, they must attend these local institutions. Hence an organization of the professional curriculum which makes possible the completion of general studies before admission to the professional school, seems to fit the emerging pattern of higher education in the United States.

The alternative arrangement in which professional and general studies parallel one another throughout the period of higher education, though administratively less desirable, has compelling educational merits. The proportion of general studies and professional studies would vary in any particular year. An ideal arrangement might be one in which the earlier years would be composed primarily of nonprofessional and the later years primarily of specialized instruction. As a freshman the student might take seventy-five percent of general and twenty-five percent of professional subjects, with a gradual reversal of these proportions until in the last year they would be approximately seventy-five percent of specialized and twenty-five percent of general subjects. This is the arrangement which in fact prevails at present in many four-year pharmacy, engi-

neering, and commerce curricula, and it is one recommended by the *President's Commission on Higher Education* whose members have said, "Liberal education can be thoroughly useful when its relevance to life is brought sharply into focus by a vocational purpose which gives point and direction to the student's program. The danger of futility lies in an unfocused, aimless study of liberal subjects. For this reason the traditional segregation of liberal education in one period of a person's college career and of professional education in another has not served the best interests of either.

"The aim should be to integrate liberal and vocational education, letting them proceed simultaneously though in varying proportions throughout the students' college life, each enriching and giving meaning to the other." The real question before pharmacy schools which offer a four-year integrated curriculum then is, "Should this pattern be changed as the course of study is lengthened to one involving the separation of professional and non-professional subject matter?"

One advantage in the integrated arrangement is its maximum use of vocational motivation. Students who expect to become doctors, lawyers, pharmacists or dentists are impatient to begin the study of subjects related to their future work. They often resent the requirement that they spend from two to four years in a liberal arts college studying courses many of which seem at the moment to have no relationship whatever to professional practice. A premedical student, for example, commonly considers all courses other than the sciences a needless diversion from his main purpose. That many successful members of the profession have a contrary point of view concerning the value of other studies is not a matter of very great moment at the time. This lack of motivation in the preprofessional program no doubt often accounts for the improvement in the student's performance when he takes up his professional studies. Only then does the full driving force of professional motivation become operative.

Speaking of the value of capitalizing vocational motivation, Howard Mumford Jones in his *Education and World*



*Tragedy* says, "It is wonderful how, when the individual establishes such a goal, education comes into focus. The postponement of the necessity for such a decision by two years has left the student wandering aimlessly through freshman and sophomore courses unrelated to each other and meaningless to him, since his understandable attitude is that they are patiently to be endured until he is permitted to begin his real education. But if from the beginning of his college work—indeed, if possible, before beginning that work—the student is faced with the necessity of making an adult choice of occupation, it soon becomes possible for the college to deal with him as an adult. His professional or vocational training will not then be crowded into the last two years of a four-year curriculum, and his "liberal" education will not be administered in the vast and shoreless void of two years of drift; on the contrary, the two can be administered together, the practical necessities of the one will focus the theoretical implications of the other, and the deeper the student plunges into his professional or vocational work, the more clearly will he see the necessity of a governing philosophy."

In a combined program student motivation is further increased by the feeling of a certain professional *esprit de corps* from the very day that he enters upon his college education. Even in some freshman courses in pharmacy a student considers himself to all intents and purposes a pharmacist. He begins to feel an emotional and intellectual identification with the other members of his class, with the members of the faculty, and with the profession at large. This feeling of belonging adds incentive to his studies, - even those not directly related to specialized professional activities. In concrete terms this means that the boy who had little interest in English or psychology in a preprofessional program, might take an entirely different attitude toward these subjects when they were components of the professional curriculum.

The integrated curriculum has the further advantage of placing the initial selection of future members of the guild in the hands of the professional faculty. To some extent this power would remain in the latter institution even under a

plan involving preliminary studies in the liberal arts college, because requirements for admission to the professional school could specify certain courses and require a minimum level of accomplishment. At the point of admission the professional school can select those students who meet both quantitative and qualitative requirements and reject all others. There is no way of knowing, however, what the performance might have been of students previously eliminated by the admission standards, grading practices, and faculty attitudes in liberal arts colleges. Certain qualities considered desirable by members of the profession might be completely overlooked by teachers of other subject matter. Some students, if they had come into direct contact with members of the profession, might have had an entirely different point of view toward their studies and eventually might have become competent practitioners. But under the plan of separating general and professional education, members of the profession have no opportunity to consider such candidates.

This point is forcefully made by Doctor Alan Gregg, Director of the Medical Sciences for the Rockefeller Foundation: "By so much as a professional school requires preparatory courses," says he "it relinquishes to other schools a very important privilege and responsibility—the first screening or selection of its students. Whomever the colleges reject cannot even be considered by the medical schools. But more than this the professional school in making a long list of prerequisite courses says, in effect, to its future students, "The younger you are when you decide to become one of us, the more likely you are to be admitted." This is a policy that favors decisions made by students who are either precocious or immature and greatly influenced by their parents or others. As a policy it underrates the student who may arrive slowly but nonetheless soundly at the choice of his life's work. I feel that we should not forget that man, as contrasted with other animals, is characterized by an exceptionally long period of immaturity — which is one of the reasons why he can learn so much, eventually. Why then reward so sedulously the exceptions to so valuable a factor as maturity of choice?"

Those who select students in large measure determine the future character of the profession itself. It is important, therefore, that responsible members of the professions come into contact with these young people at the earliest possible moment in order not only to pick the most promising, but also to influence the formation of the attitudes and habits of those selected. The recognition of the importance of selection in determining the character and quality of a professional group has caused some schools to consider selective criteria other than grades. It is a not uncommon practice now to require an interview at the school, or if a prospective student lives at a distance, to ask an alumnus or another member of the profession to interview the applicant and to attempt to appraise his character, his attitudes and his professional motivation. Such interviewers often try to determine whether the individual looks upon membership in the profession as an opportunity to make a contribution to his own group and to the society in which he lives or as a way to make money quickly. These are, to be sure, intangible matters which deserve careful and judicious consideration if prejudice is not to creep into admission practices, and yet they are of obvious importance in determining the character of a student body and of the profession itself. Institutions which require preprofessional study to some extent surrender these prerogatives of selection to other bodies.

In organizing the pharmacy curriculum there is another advantage in providing for the simultaneous study of both specialized and general courses. Modern psychology has shown that the meaning of any experience is determined not only by the situation from which it arises, but also by the attitude and the immediate interests of the observer. To some degree we see what we are looking for. These individual interests and motivation give rise to meanings and relationships which may be quite different from those of another person who brings to the situation a different background of understanding.

Moreover, it is an established psychological fact that meaningful material is learned more quickly and retained longer than that which the psychologists have termed "nonsense material". The latter, composed mostly of sensory data un-

related to the person's previous experience, is incapable of arousing meaningful associations. The less meaning new material has for a student the more he inclines to learn it by mere memorization, for he finds difficulty in establishing connections between the new material and that which he already knows. Hence, the learning process becomes mechanical and with the passage of time the residue of learned material rapidly shrinks.

Now the implication of these facts of modern psychology is that a curriculum which integrates both general and professional studies rests on firmer psychological ground than one in which they are separated. Concretely this means that in a course in chemistry, the student who has already begun the study of pharmacy will approach the study of chemistry with a quite different point of view from one who has not. All non-professional courses will have more meaning, because of the student's associations with the subject matter of his chosen field of work.

It does not follow, however, that special courses with a vocational orientation should be offered in all the nonprofessional subjects. Some years ago one school of thought, resting its case on the assumption that there was no transfer of training from one situation to another, argued that there should be a course in inorganic chemistry for the future doctor, another in inorganic chemistry for the future pharmacist, still another for the student who planned to major in the non-scientific fields, and so on *ad infinitum*. As a result of this educational philosophy basic courses in the various subject matter fields were, and in some institutions still are, needlessly specialized and fragmented. Later research on the transfer of training shows, however, that when teaching has generalization of experience as a conscious aim, much transfer of experience can take place. It is now generally agreed that students should learn the fundamental principles of a subject, and having done this they will be able to make the necessary applications to new situations.

It would be a mistake, therefore, to suppose that the integrated curriculum in pharmacy embodying both specialized

and general subject matter should in the basic disciplines contain only the knowledge and the skills which the future pharmacist will need. This is not an argument for inorganic chemistry and organic chemistry for pharmacists, for pharmaceutical physics or English composition for pharmacists. It represents the view that if pharmacy students pursue professional courses simultaneously with their general courses they will *themselves* see meanings in general chemistry, physics, mathematics, economics, and English which would otherwise be obscured. Under this arrangement there should be a steady flow of meaning back and forth between specialized courses in pharmacy and general courses in the basic sciences and in other subjects, each adding meaning to and reinforcing the other. Thus the student would learn material more rapidly in both types of courses and retain it longer than if they were studied in succeeding years, or what is more likely in years more widely separated.

This suggests a further psychological fact that should be mentioned in support of the integrated curriculum. Psychologists who have studied the retention of learned material in various college courses have discovered that much of what is acquired in one academic year is forgotten by the next unless it is constantly revived. Indeed it has been shown that in some college subjects students forget from a quarter to a half of the detailed knowledge from the end of one academic year to the beginning of the next. Thus a prepharmacy student who studies elementary physics in 1948 will, by the time he enters the school of pharmacy and needs this subject matter as a basis for professional courses, have forgotten much of what he had learned several years earlier. The same statement may be made with regard to the other instruction which is supposed to support the specialized courses in pharmacy. It must be admitted that many of the major principles of the subject will be remembered if instruction in the college of liberal arts has emphasized such matters and avoided a laborious memorization of details. Unfortunately, however, instruction which gives the student an adequate knowledge of, and experience in, the application of principles cannot be



assumed. If, however, the student studies courses in physics and chemistry while pursuing instruction in pharmacy in which the principles of these scientific subjects are constantly being used, he will make the necessary applications. Sound pedagogical theory and practice argue overwhelmingly in favor of the pharmacy curriculum which includes general or liberal subjects and professional subjects offered concurrently.

There is the further question of the value of additional education, not only to the individual, but to society at large. Through the years all professions have steadily added both specialized and general studies to their curricula. In little over a half century many professional courses of study have grown from two academic years of about six months, to six or eight post high school years of education to which have often been added apprenticeships or internships of from one to five years. Many persons within the professions, and laymen too, though fully conscious of the growing body of knowledge in the specialized branches, and also of the need for additional education for the responsibilities of citizenship, are nevertheless wondering whether we are not reaching the limit of the proportion of a life that can be devoted to formal education. This attitude was strikingly revealed in one of the professions during the past five years when a number of institutions of higher education, and their students, rebelled against a graduate program which they considered excessively long and specialized. It seemed to them that the profession was arbitrarily adding requirements to upgrade educational standards, while at the same time hundreds of positions were unfilled demanding less than such advanced specialized education. The result was the establishment of a new accrediting body willing to recognize a program of professional education somewhat less demanding and less time consuming than that projected by the older accrediting body. It is reasonable to assume that if other groups needlessly extend the educational requirements for admission to the professions, similar reactions may occur. Those interested in preserving the advances that have been made in professional education must recognize, therefore, that an ill-considered

increase in the length of professional education may lead to lower rather than to higher standards.

Before adding one or two years of preprofessional study, the profession of pharmacy, in the interest of self-protection as well as in the interest of the public good, should ask itself the question, "Is this instruction necessary to improve the standards in pharmacy and in American living in general?" If this question is answered affirmatively, the profession must then answer a second question which is, "If additional education is necessary, can it be provided more effectively and more economically in two agencies or within a single curriculum embodying both general and specialized courses?" The answer to the first question is probably "yes", though many studies will be required to show how much and what kinds of new instruction will be required to make a better pharmacist and a better citizen.

In view of the facts thus far presented, the answer to the second question would seem to be that the educational advantages are preponderantly on the side of a plan embracing the simultaneous study of both general and professional subject matter. The profession of pharmacy can make a valuable contribution, not only to its own membership, but also to education at large by courageously following the logic of educational theory, and by disregarding invidious comparisons with professions in which a preprofessional requirement is now the practice. There is no educative value in living up to the Jones'. An objective and realistic examination by the schools of pharmacy and the profession at large of the relative advantages of the integrated program should lead to an acceptance of such a plan in place of one in which part of the education of the pharmacist and the selection of the future members of the profession would be turned over to other agencies. By taking the steps necessary to preserve the present desirable integrated courses of study in pharmacy, while at the same time extending the requirements in both professional and general subject matter, the profession of pharmacy can make a significant contribution not only to its own advancement but to the thinking of members of other professions with regard to this important matter.



## The Applications of Plant Growth Regulators Including Radiations to Research in Pharmacognosy\*

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Since the classical findings of Boysen Jensen<sup>1,2</sup> who showed that bending responses in corn seedlings were caused by phytohormones within the plant and the classic work of Went<sup>3</sup> who showed how these phytohormones could be quantitatively assayed by using oat coleoptiles, a tremendously active field has developed in plant research which has in twenty years unfolded many of the mysteries of growth. Not only have many mysteries of plant growth been explained, but naturally occurring phytohormones, once called auxins<sup>4</sup> (Kogl's auxin *a*, auxin *b* and heteroauxin) have now in the light of chemical studies been isolated and synthesized to become important plant growth regulators. The chemical identification of naturally occurring plant hormones has led to the formulation of such a list of synthetic chemical substances and their derivatives which act as plant hormones that literally a chain reaction of outstanding problems is daily unfolding in the fields of plant research.

Among the more commonly used of these chemical regulators are such organic acids as indolebutyric, indoleacetic, naphthaleneacetic, indolepropionic, indolepyruvic, phenylacetic, naphthoxyacetic, chorophenoxyacetic, their esters and salts. To this list can be added the alkaloid colchicine, ethylene, ethylene chlorohydrin, ether, the podophyllin constituents, and others. Thus far the application of these organic substances has been largely used in horticulture and agriculture such as the use of *indolebutyric*, *naphthaleneacetic*, and *di-* and *trichlorophenoxyacetic* acids (their esters, sodium

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and potassium salts) in stimulating root and stem development. Recently Pratt, Dufrenoy, et al<sup>18</sup> have stimulated the development of root initials by the use of *Salicylacetone*, 4 (O-hydroxyphenyl - 3 butenone - 2). These workers suggest the possibility that sulfhydryl (R-SH) groups added to substituted vinyl ketone groups may induce similar effects on root and stem growth. Related homologues and analogues of vanillylacetone and hydroxynaphthal acetone have been suggested. *Cresylic acid* and esters and various tar-oil distillates, 2-4-D and *naphthaleneacetic acid* have been used in blossom thinning, pre-harvest dropping, and fruit set control. Acenaphthene, 4-Floureneacetic acid, and colchicine in addition to the above substances have been used to stimulate the growth of ovaries and hasten fruit set. In a like manner many of these chemicals have been applied in horticulture to hasten or retard the time of flowering in order to provide for extended marketing seasons. *Ethylene chlorohydrin*, *acetaldehyde*, *ethylene dichloride* and others have been employed in breaking seed dormancy and reducing the rest periods of plants. In contrast, potassium salts and methyl esters of *naphthaleneacetic acid* have been used to prolong dormancy thus preserving edible roots and protecting orchards from late frosts.

The use of certain of these organic substances in weed control has become commercially important since the epic findings of Zimmerman and Hitchcock<sup>19</sup>, Kraus and Mitchell<sup>20</sup>, and others. For this purpose the most commonly used organic chemicals have been the *di*- and *trichlorophenoxyacetic acids* (2,4-D and TCP), their esters and salts, the thiocyanates, the *dinitro orthro cresylates*, *ammonium sulfamate*, *butylphenols*, etc. The retail pharmacist, incidentally, handles most of these under a host of manufacturers' specialty names such as "Weed-No-More", "Esteron", "Weedone", "Sinox", "Dee Cee Pee", etc. Other compounds not yet tried sufficiently but which give evidence for inhibiting growth in plants are *succinimide*, *p-nitrobenzaldehyde* and *vitamin K-5* (2-methyl-4-amino-1-naphthol hydrochloride). Pratt<sup>21</sup> and coworkers have used the latter to success in preventing *Penicillin*, *Trichophyton*, and other fungus growth in agar cup plate tests.

No less spectacular in plant research has been the development of certain physical growth regulators such as those caused by radiations (neutrons, protons, alpha, beta and gamma rays, etc.), and produced by Uranium pile exposures, cyclotrons, radium and x-rays. Lately the use of radioactive tracer elements for tagging plant constituents has caught the attention of chemists, physicists, and biologists the world over.

Since early in the twentieth century with the researches of Muller<sup>6</sup>, Darlington<sup>7</sup>, Sax<sup>8</sup> and many others, chromosomes and their genes, which are the centers of the most important functions of plant and animal life, have been guided and modified severely by such physical growth regulators as x-rays and radium rays.

The question arises as to what role should the pharmacognosist play in this vast armamentarium of agents which affect life. The following are a few suggestions for thought:

#### *Chemical Growth Regulators*

In the field of chemical growth regulators the pharmacognosist might well speculate upon two vastly important subjects; first there is the effect upon genetic behavior by any one of the aforementioned agents to the extent of producing better strains of drug plants wherein important active constituents might be increased; secondly there is the possibility, as yet not entirely confirmed, of inducing increased yields of active constituents by treating certain drug plants with organic substances having structures similar to basic portions of the naturally formed plant constituent.

In the first category, so extensive has been the use of certain chemicals, i.e., colchicine and 2,4-D, in the production of new varieties that the laboratory uses of these have passed into the practical hands of the plant breeder and horticulturist. The pharmacognosist is already aware of the fact that polyploid plants resulting from such treatment show significantly

higher yields of certain chemical constituents over normal diploids. For example, Rawson<sup>7</sup> and Miller<sup>10</sup> showed that the *Datura* alkaloids were higher in amounts in tetraploids. Warmke<sup>11</sup> produced larger quantities of the cannabis alkaloids in colchicine-produced tetraploids of Marihuana. Nicotine has been found in greater quantities in *Nicotiana* polyploids; camphor, in basil leaves; Vitamin C in certain vegetable leaves and fruits; sugars and enzymes increased in still other polyploids. Thus one might speculate at length on similar research using other organic structures resembling colchicine. Recently the findings of King and Sullivan<sup>12</sup> that podophyllin and its constituents have similar effects on chromosome rearrangement to those caused by colchicine furnishes still another chemical tool. From such research the pharmacognosist might well study the application of other chemicals as chromosome effector to plant and animal tumorous growth. In fact, he might set up a series of screening experiments using onion root tips, tradescantia stamen hairs, or echinoderm eggs, and observe the effects of as many naturally occurring and synthetic compounds as possible upon mitotic figures. Techniques and procedures are reported in the literature, and the basic principles of such observations are included in undergraduate and graduate courses in cytology and cytogenetics.

Not only do genetical studies of this type lead to practical applications, but they become research methods for the study of focal points for the development of important plant constituents. It now appears that alkaloids and glycosides, for example, are genetical bodies in origin. However, much more evidence is desired by those who would affirm this stand.

The second category of inducing growth changes including changes in plant constituents by using chemical substances having similar structures has grown from the copious research in the field of chemical growth regulators such as the plant stimulants and the herbicides. This research is not entirely new, for early in the century Ciamicin<sup>13</sup> and his co-workers experimented with pyridine, piperidine, and additional pyridine compounds with the purpose of showing that these were alkaloid precursors in *Datura* and Tobacco. Although

some positive evidence of this was reported, it has since not been confirmed. However, a list of similar researches using various organic acids, esters, salts, and other derivatives as homologues and analogues would seem to be of great value. From the published literature and from research conducted in this laboratory there is little doubt but that simple and complex organic compounds are absorbed in some degree by plants. The greatest evidence for this has been shown by several (See suggestive readings.) following treatments with indoleacetic acid, indolebutyric acid, naphthalenacetic acid, and the phenoxyacetic acids, esters, and salts. Youngken<sup>16</sup> has shown the results of induced treatments of *Datura* with pyridine, piperidine, atropine sulfate, 2,4-D, succinimide, and isopropyl alcohol. That the plant responds to these substances by showing formative growth effects indicates that these chemicals in toxic and trace amounts must be absorbed in some manner. That no significant alkaloid changes were found following assay studies of the first four indicates possibly that none of these was used biosynthetically. But the role of alkaloidal formation in plants is obscure and the pharmacognosist should explore further this theory of organic precursors before final conclusions can be drawn. Tropine and tropic acid might be induced into plants having alkaloids of the hyoscyamine type. Cholesterol and similar compounds of the penteno-phenanthrene basic structure might be studied in this fashion relative to certain plants of the *Digitalis* glycoside group. Miller<sup>17</sup> has shown evidence of glycoside synthesis in Tobacco plants, potato tubers, and others following induced treatments with ethylene chlorhydrin. Thus, simple glycoside structures can be formed by organic chemical agents used as regulators and the possibilities of still others already appear to be numerous. Certainly research in the application of organic molecules to plant metabolism might well yield results far more interesting than even now realized.

The technique for such studies involves growing plants in soil media and sand cultures to which test solutions can be added. These can be supplemented at will by applying chemical substances in ointment form. Plant stems do absorb several complex organic substances<sup>18, 19</sup>. Injections are also pos-



sible. These can be accomplished by inserting hypodermic needles into the stem lumen and within certain limits forcing test solutions into the stem. Glass tubing can be secured for insuring a clear avenue". Finally, leaf spraying or immersion can be employed. This is the common method by which most weedicide chemicals are used. Of all methods the quartz sand culture utilized since the work of Hoagland and others provides for the most accurate study. Formulae for nutrient solutions are well established and can be found in most texts on the subject. Since the work of Dawson and others<sup>22</sup> on reciprocal grafts in *Datura* and *Nicotiana* species it would seem definite that the roots of these plants are the sites of alkaloid formation. Thus research in alkaloid synthesis should employ root immersion in chemical test media. Sand cultures would therefore be well controlled in such a study. Not only can added solutions be assayed but within limits drained media can be analyzed. Although concrete hydroponic beds and greenhouses are ideal for such research these are by no means prerequisite. Ordinary 2 gallon glazed quartz crocks with proper drainage apertures are adequate. These can be set up in a well lighted room freed of laboratory gases and the pharmacognosist who is handicapped by lack of proper facilities can still accomplish preliminary screening and analysis. Of course a well equipped greenhouse and experimental plant garden are recommended for more thorough research.

#### *Radiation and Radio Isotopes*

As was indicated earlier during the discussion, the field of physical growth regulators provides for a wealth of research in pharmacognosy. Among the tools that can be employed here are the effects of radiation and the use of radio isotopes. This research requires a sound knowledge of the science of nuclear transmutation and of the methods for analysis of radiant energy. Nuclear physics in any of its manifestations is the science mastered to date by a select few. The majority of biologists and chemists must delve into a learning of these concepts the hard way before an understanding of basic principles can be intelligently applied to research using such methods. Thus, there is presented a challenge to the pharmacog-

nosist. He should employ every means to learn from his colleagues in physics and should not be reluctant to obtain tutoring whenever necessary. Certainly the available assay procedures and techniques employing Geiger counters and radiographs should be done with competent assistance. Fortunately to date several texts have been made available for the researcher who has had a minimal contact with nuclear physics and chemistry. Among these is Martin Kamen's "Radioactive Tracers in Biology" (Academic Press, Inc., New York, 1947). Another is by D. E. Lea entitled "Actions of Radiations on Living Cells" (The Macmillan Company, New York, 1947). Recently a symposium on isotopes as used in biology and medicine has been published by the University of Wisconsin Press under the title, "Isotopes in Biology and Medicine" by H. D. Clark *et al*, (1948). A study of these is extremely beneficial as most are well referenced. The Isotopes Branch of the U. S. Atomic Energy Commission, Oak Ridge, Tennessee, has made available a catalogue and price list of radioisotopes including a section on stable isotopes, that can be procured from the Clinton Laboratories. This pamphlet also gives data relative to obtaining service irradiations. Form 313 "Request for Radio-isotopes" may be obtained from the same service.

Among several of the interesting researches published during the past year and which provide thought for drug plant experimentation are the following: Wood, Mitchell, and Irvine<sup>28</sup> measured the amounts of radioactive iodine in Bean and Barley plants. The iodine was incorporated into 2-iodo-3-nitrobenzoic acid (INBA), a chemical growth regulator. Aronoff<sup>29</sup> and coworkers studied the distribution and assimilation of radioactive carbon dioxide in the light by young barley plants. These workers describe a convenient reaction chamber. Mitchell<sup>30</sup> studied the growth rates of bean and oat plants using the labeled growth regulator 2-iodo-3-nitrobenzoic acid to find evidence for the linkage of this compound with the constituents of both plants. Amason<sup>31</sup> conducted a series of experiments using radioactive phosphorus ( $P^{32}$ ) on mutation induction in species of *Triticum*. Calvin and Benson<sup>32</sup> traced the path of carbon in photosynthetic studies using the algae,



*Chlorella* and *Scenedesmus*. Radioactive phosphoglyceric acids, sugar phosphate, and others were obtained. Putman, E. W. *et al*<sup>2</sup> showed how carbon-labelled sugars may be prepared in Turkish tobacco leaves and *Canna* spp. by using barium carbonate containing in each 500 mg. approximately 0.25 millicurie of C<sup>14</sup>. These workers describe a photosynthetic chamber and methods of extraction. For example, in one test from several starch preparations made with approximately 230 microcuries of C<sup>14</sup> in 0.5 Gm. of barium carbonate -from 20 to 25 per cent starch was obtained. The specific activity of the starch was from 0.48 to 0.72 microcurie per mg. Preparations of labeled glucose and fructose were then made from the activated starch.

Using techniques of the above nature the pharmacognosist could well engage in attempts to label many naturally occurring drug plant constituents. Although limitation will undoubtedly be encountered, a program of research following these thoughts might be promulgated. The possibility of using radioactive carbon in the form of CO<sub>2</sub>, carbon labelled barium carbonate, and carboxyl-labelled acetate and feeding to any number of therapeutically important medicinal plants should prove worthwhile. Other radioactive elements similarly might be induced in plant feedings and drug constituents observed.

Finally, radiation effects induced by subjecting plant parts to exposures of x-rays, radium, and cyclotron bombardments provides material for research in pharmacognosy. Thus far retardation in certain seed germinations have been observed following varying exposures to x-ray and cyclotron irradiations by this laboratory. Although this research has not been completed the effects induced in *Digitalis* and *Belledonna* seed germination and seedling survival show marked retardation following doses of from 10,000 to 20,000 roentgen units. From the published findings since the time of Muller<sup>3</sup> changes in genetical mechanisms might well be expected. Such changes indicate possibly changes in drug constituents formed by these plants. Changes induced in plant constituents by such factors will further link the formation of the constituents with chromosome functions, etc. Any number of in-

teresting enlightments into the biosynthesis of chemical constituents might thus be attained.

### Conclusion

If basic principles in chemistry, biology and physics are properly mastered and if the graduate student in pharmacognosy has an inherent capacity for imagination he should do well to embark upon a study of the effects that can be induced by plant growth regulators. The agents from which to select are numerous and are chemically and physically excellent tools for creating new forms of plant life or for modifying older forms of plant life. Thus when placed into the hands of an enthusiastic student of drug plant study the student can achieve a better understanding of the life mechanisms of these organisms and at the same time might well cause the biosynthesis of newer constituents or effect an increase in formation of already established chemical principles.

Finally, with the event of radioactive isotopes the pharmacognosist through drug biosynthesis and labelling tracers might well provide the physiologist and pharmacologist with additional tools for better understanding drug action in animals.

- (1) Boysen Jensen, P., *Ber. deut. botan. ges.*, 28 118-120 (1910)
- (2) \_\_\_\_\_, *K. Danske Videnskab. Selskab, Forh.*, No. 3 1-24 (1911)
- (3) Went, F. W., *Rec. Trav. botan. neerland.*, 25 1-116 (1928)
- (4) Kogl et al, *Hoppe-Seybr's Z. physio. Chemie* 214 214-261 (1933)
- (5) Muller, H. J., *Amer. Nat.*, 64 220 (1930)
- (6) \_\_\_\_\_, *Act. Sci. Ind.* No. 725 477 (1938)
- (7) Darlington, C. D., *Recent Advances in Cytology*, London (1937)
- (8) Sax, K., *Genetics*, 23 494 (1938)
- (9) Rowson, J. M., *Nature (London)* 154 81-82 (1944)
- (10) Miller, O., Fischer, L., *J. Am. Pharm. Assoc.*, 35 23 (1946)
- (11) Warmke, H. E., *Carnegie Inst. Washington Year Book*, 41 186-189 (1942)
- (12) \_\_\_\_\_, *ibid*, 42 153-157 (1943)
- (13) King, L. S. and Sullivan, M., *Science*, 104 244-245 (1946)
- (14) Ciarniacin, G. and Ravenna, C., *Atti. Acad. Lincei*, 20 614 (1911)
- (15) Youngken, H. W., Jr., Fischer, E. B., *J. Am. Pharm. Assoc.*, 31 9 (1942)

- (16) \_\_\_\_\_, *ibid*, 37 196 (1948)
- (17) Miller, L. P., C. B. T. I., 9 213-221 (1938)
- (18) Dufrenoy, J. et al, "Growth Regulating Action of Salicylacetone" (in publication)
- (19) Zimmerman, P. W. and Hitchcock, A. E., *Contrib. Boyce Thompson Inst.* 12 321-343 (1942)
- (20) Kraus, E. J. and Mitchell, J. W., *Botan. Gaz.*, 108 301-350 (1947)
- (21) Pratt, R. et al, "Vitamin K-5 as an Inhibitor of the Growth of Fungi and of Fermentation by Yeast" (in publication)
- (22) Levine, M., *Bull Torrey, Bot. Club.* No. 4, 63 177 (1936)
- (23) Dawson, R. F., *Amer. Journ. Bot.*, 29 813-15 (1942)
- (24) \_\_\_\_\_, *ibid.*, 29 66-71 (1942)
- (25) Isotopes Division Catalogue No. 2, U. S. Atomic Energy Commission, Oak Ridge, Tenn.
- (26) Wood, J. W. et al, *Science*, 105 337-339 (1947)
- (27) Aronoff, S. et al, *ibid*, 105 664-665 (1947)
- (28) Arnason, T. J. et al, *ibid*, 107 198-199 (1948)
- (29) Calvin, M. and Benson. A. A., *ibid*. 107 476-479 (1948)
- (30) Putman, E. W. et al, *J. Biol. Chem.*, 173 785 (1948)

#### SUGGESTED READINGS:

- Avery, G. S., Jr., et al "Hormones and Horticulture"  
McGraw-Hill Book Co., New York (1947)
- Crocker, W. "Growth of Plants"  
Reinhold Publishing Corp., New York (1948)
- Laurie, A., et al "Commercial Flower Forcing"  
5th Ed. The Blakiston Co., Philadelphia (1948)
- Lea, D. E. "Actions of Radiations on Living Cells"  
The Macmillan Co., New York (1947)
- Kamen, M. D. "Radioactive Tracers in Biology"  
Academic Press Inc., New York (1947)
- Clarke, H. D., et al "Isotopes in Biology and Medicine"  
University of Wisconsin Press, Madison, Wisconsin (1948)

#### AN APPRECIATION

The October 1948 issue closed the twelfth year of publication. For the twelfth time Prof. Zada M. Cooper prepared the annual index which is enclosed with the current number. It's an arduous task for which we are grateful. Also, we are not unmindful of the services of the collaborators throughout the year. It is due to their painstaking efforts that we have been able to record what is going on in our educational institutions.—Editor

## A Lecture Demonstration Permitting Student Participation in the Use of a Surface Tension Pipette

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The thoroughly reliable drop-weight method<sup>1</sup> or the less reliable drop-number method<sup>2</sup> for the determination of surface tension has been applied in many ways<sup>3</sup>. Recently the authors had occasion to develop a lecture demonstration based upon this principle. The instrument, a surface tension pipette or stalagmometer, finally selected for this project was a modified Traube pipette<sup>4</sup> which may be used for a striking demonstration that enables all of the members of a large audience to compare the surface tension of different aqueous solutions by direct observation. It is also well suited for laboratory instruction of pharmacy students who may be encouraged to use the drop-number method for the practical estimation of the surface tension<sup>5</sup> of many dilute aqueous solutions containing surface active agents.

*Experimental:* The instrument may be employed generally by the application of the usual refinements<sup>6</sup>, but for solutions that may be assumed to have a specific gravity approximately equal to the reference liquid, it is ideally simple. A 2 cc. or 5 cc. pipette is modified so that the lower delivery tip is made from a section of glass capillary tubing having an outside diameter of 4 to 8 mm. The tip is ground square with emery cloth or carborundum powder, and the capillary is selected, or later constricted, so that the free delivery rate is slow enough to produce drops that are easily counted. The pipette is filled with pure water, and later with solutions, to any predetermined mark, just as if it were an ordinary delivery pipette. After it is filled it is suspended from a clamp with the aid of a one-hole stopper or similar device, and the number of drops falling

from it are counted. For the purpose of lecture demonstrations, the drops are allowed to fall from a height of about three feet onto a shallow, metal pan, such as an inexpensive aluminum pie pan, selected and mounted so as to produce maximum sound as the falling drops strike the metal surface. The sounding plate must be tilted to avoid accumulating a reservoir of liquid at the point where the drops strike. For large audiences the microphone of the public address system should be held near the sounding plate.

*Calculations:* For rapid approximate work, surface tension is calculated by assuming it to be inversely proportional to the number of drops falling from the same pipette. A clean surface tension pipette, or stalagmometer, should be calibrated with good water (tap water may be satisfactory) or other reference liquid. The calibration is permanent for a given pipette, and is accomplished by counting the number of drops of a reference liquid of known surface tension that falls from the pipette after it has been filled with the reference liquid to a predetermined mark. If the pipette has no mark on the upper stem, it should be marked with a suitable etching tool at a point selected by trial and error to give an integral number of drops, although the estimation of a fraction of a drop is not a serious source of error. The number of drops delivered is multiplied by the surface tension of the reference liquid (72 dynes/cm. for water at room temperature). The product is recorded as the "calibration product" of the pipette. To measure the surface tension of an unknown liquid, determine the number of drops of the liquid delivered by the calibrated pipette when filled to the predetermined reference mark; divide this number of drops into the "calibration product" of the pipette to obtain a quotient which is the surface tension of the liquid in the units used to express the surface tension of the reference standard. The calculation may be summarized by the equation,

$$T_1 = (T_2 N_2) / N_1$$

where  $T_1$  and  $N_1$  represent surface tension and number of drops respectively, of the unknown liquid, and  $T_2$  and  $N_2$  refer similarly to the reference liquid.  $T_2 N_2$  is the "calibration product" for the pipette.



*Discussion:* The use of a Traube pipette or stalagmometer for the determination of surface tension has fallen into disuse largely because more elaborate methods have replaced it. This is unfortunate, especially for pharmacists who might use the method to good advantage even with the aid of a common medicine dropper. For this purpose the dropper should be made to leak air through or around the rubber bulb so as to allow the contents to be delivered slowly; the rate at which the drops form and the amount of mechanical vibration at the tip play an important role in securing reproducible results. It has been shown that an ordinary medicine dropper tip is not an ideal surface for this type of work, but in many cases a rough estimate of surface tension is all that is required to detect the presence of surface active agents in relatively high concentrations.

When attempts are made to refine the drop-number method, various difficulties are encountered. For liquids that attain surface equilibrium in a very short time, such as relatively concentrated solutions of surface active substances, the drop-number method may be expected to yield surface tension values that agree with values obtained by other standard methods. Accuracy in dealing with solutions of this type in the pipettes described above may be estimated from the error inherent in estimating fractional drops and in assuming constant specific gravity. If desired, a specific gravity correction may be applied by converting the original drop-count to the number of drops per unit weight, a better basis for comparison than the number per unit volume. The accuracy that is readily obtained without special attention to detail is shown in Table I. The more concentrated solutions of benzalkonium chloride give approximately the same reading with a surface tension pipette as with the du Noüy ring method. It will be noted, however, that the more dilute solutions give one series of values with the ring method and another with the pipette method. This difference may be due to the rate of attaining surface equilibrium. This and other anomalous behaviors of the quaternary ammonium compounds suggest the need for further investigation.



*Results:* Table I shows results obtained by the normal ring method as compared with results obtained with pipettes that deliver rapidly enough for convenient demonstration. Corresponding samples for both methods were taken from the same batch of solution in order to eliminate the possibility that observed differences are due to slight errors in preparing the solutions. Reproducibility of the tabulated results was established by redetermining the surface tension values of freshly prepared solutions. As a further check on the validity of the experiments, attempts were made to alter the age of the liquid surface studied by the ring method. Vigorous mechanical agitation of the liquid surface just before taking a reading with the du Noüy tensiometer caused an apparent increase in the surface tension values of the more dilute solutions, approaching those obtained with the surface tension pipettes. These higher values obtained by the ring method were so critically dependent upon the type of agitation employed that they were not recorded. The values actually recorded for the ring method were reproducible and were obtained by the use of standard technique within the two or three minutes allowed to complete each determination.

*Summary:* A modification of the falling drop method for the determination of the surface tension of solutions is described. This modification provides a useful teaching aid for the demonstration of surface active agents, especially for large audiences. Surface tension values for benzalkonium chloride solutions of different concentrations, as determined by the method described and also by the du Noüy ring method, are presented. Excellent agreement between the two methods is reported for the more concentrated solutions studied, however a consistent difference between the values obtained by the two methods for the more dilute solutions is observed.

TABLE I  
Results with Surface Tension Pipettes

Solution	Surface Tension Du Nouy dynes/cm	Pipette No. 1 Calibration 72 x 21 = 1512		Pipette No. 2 Calibration 72 x 15 = 1080		Pipette No. 3 Calibration 72 x 28 = 2016	
		No. Drops	S.T.	No. Drops	S.T.	No. Drops	S.T.
Water	72	21		15		28	
Benzalkonium Chloride 1-500 (Zephiran)	37	43	35	—	—	57	35
" " 1-1000	35	39	39	28	39	51	40
" " 1-5000	40	29	52	—	—	38	53
" " 1-7500	47	25	60	—	—	32	63
" " 1-10,000	47	23	66	17	64	30	67
Zephiran Chloride 1-1000 plus 9-Aminoacridine hydro- chloride 1-500	40	30	50	23	47	40	50
Phemerol 1-1000	37	44	34	32	34	59	34

#### References

1. "International Critical Tables," Vol. IV, p. 435, McGraw Hill Book Co., New York, 1928.
  2. "Physio-Chemical Methods," Reilly and Rae, W. N., Vol. I, p. 517, Ed. 3, D. Van Nostrand Co. Inc., New York, 1939.
  3. "Physical Methods of Organic Chemistry," Weissberger, A., Vol. I, p. 172, Interscience Publishing Co., New York, 1945.
  4. "Colloid and Capillary Chemistry," Freundlich, L., (Translated from the 3rd German Edition by H. S. Hatfield) p. 21, E. P. Dutton and Co., New York, 1922.
  5. "Experiments in Colloid Chemistry," Hauser E. A., and Lynn, J. E., Ed. 1, p. 51, McGraw Hill Book Co. Inc., New York, 1940.
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#### Errata:

How it happened is a mystery, but the second page of the list of collaborators in the October, 1948, issue is confusion personified. The list in the current issue is correct.

Also, in the list of Past Presidents, the dates following the name of Dean J. Grover Beard should read 1929-30, instead of 1925-26.

Dr. George Urdang has called attention to the fact that the Report of the 1948 meeting of the A.I.H.P. at San Francisco, (A.J.P.E., Vol. 12, No. 4, pages 796-797), does not mention that the first and third joint sessions were presided over by the officers of the Section on Historical Pharmacy of the A.Ph.A. This omission embarrassed Dr. Urdang. The fault lies entirely with the Editor who abstracted the report in order to save space and give the essential facts that he felt would be of interest to our readers. Inadvertently, he signed Dr. Urdang's name to the abstract, instead of his own.

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The Canadian Conference of Pharmaceutical Faculties has recently begun the publication of a bulletin in mimeograph form. It covers news and matters of pharmaceutical interest to educators in Canada, and gives considerable amount of news concerning pharmaceutical education in the United States.

## Address of the Chairman of the Teachers' Conference on Graduate Instruction\*

OLE GISVOLD

University of Minnesota, College of Pharmacy

Because I am connected with pharmaceutical chemistry at the College of Pharmacy, University of Minnesota, my interests are primarily related to the fields of chemistry such as inorganic, organic, biological, physiological, analytical and physical and chemotherapy. A certain amount of fundamental knowledge in each of these fields is, in my opinion, necessary to understand, carry on or direct successfully research in the field of pharmaceutical chemistry. In addition, a more complete understanding is gained if one has some knowledge of physiology bacteriology and pharmacology, together with those courses usually offered in the undergraduate programs in colleges of pharmacy.

The above views become apparent when one recalls the source, composition, method of manufacture (i.e. isolation from plant or animal source or synthetic methods), chemical and physical properties, activity and mode of action of the various chemical compounds now prepared for use in the practice of pharmacy and medicine or as a basis with which to formulate a research project that will lead to the preparation of a new medicinal agent.

Much of our future research in the preparation of new drugs and an understanding of the mode of action of some of the drugs we now have rests upon a more complete understanding of the fundamental biological processes that involve simple and complex enzyme systems in man, animals and bacteria. At the present time one phase of pharmaceutical chemistry is concerned with new medicinal agents and can be roughly clas-

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\*Read before the Conference of Teachers of Graduate Instruction at the 1948 meeting in San Francisco.

sified as follows: 1) The synthesis of new drugs that are structurally related to known active compounds in an attempt to improve upon them. Some of this is "hit and miss" research and some of it is guided by certain theories of activities. 2) The preparation of new drugs that are related in structure to some compound that is part of an enzyme system such as a co-enzyme. 3) The "hit and miss" type of the synthesis of an effective medicinal agent. This type of research can lead to the preparation of a wide variety of drugs some of which on the one hand can yield physiologically active compounds. 4) The isolation of an active substance from plant, animal and bacterial sources. Until such future time as we may have a more complete understanding of biological processes, the above methods of approach must be followed. Some of these methods are rational and effective insofar as our present knowledge is concerned. This is just one phase of pharmaceutical chemistry which is perhaps the most attractive and, if I may use the term, "glamorous". Most true scientists do not look for glamour as one of the rewards of their tedious efforts. The satisfaction of a job well done suffices for most scientists.

This phase, as well as other phases, of pharmaceutical chemistry research are carried on by both educational institutions and commercial concerns. The latter primarily in search of medicinal agents to sell and the former primarily for the advancement of knowledge in the various fields of science involved.

There are other phases of research and teaching in pharmaceutical chemistry and because of the wide scope of knowledge required to successfully carry on in this field, leads to the conclusion that a definition of a pharmaceutical chemist might be in order. I have asked others to define a pharmaceutical chemist, but no satisfactory definition was obtained. I for one do not care to give a concrete definition. On the face of it, it might appear that the pharmaceutical chemist is a "jack of all trades" and master of none. Be that as it may, his diversified knowledge is necessary in some phases of pharmaceutical chemistry research in order to conceive of problems in his field of research. The pure organic chemist, bio-

chemist or physiological chemist has had training along such narrow lines that generally speaking he is not able, without further study, to conceive of research problems in the fields of medicinal products. Time will not permit me to elaborate on this point but I am sure that others in the field of pharmaceutical chemistry will understand.

Because the two papers to be given at this section deal essentially with pharmaceutical chemistry at the graduate level and presumably these papers will deal in part with courses given, I should like to express an opinion along these lines. A syllabus with some degree of flexibility is highly desirable and necessary for the undergraduate program. At present I do not visualize a cut and dried syllabus for the graduate school. On the contrary, I believe that a certain amount of diversification of instruction among the graduate schools in pharmacy is highly desirable for reasons that are apparent to most of us. Nevertheless, I feel that *several courses with a given course content*, both didactic and laboratory instruction should represent a *part* of all graduate programs given in the major field in all graduate schools in the colleges of pharmacy. At present, I doubt very much that this is the case. I believe that through cooperation and rationalization these courses can be formulated and agreed upon and if need be made a part, for the present at least, of an imaginary graduate syllabus. Such unanimity of opinion will add to the substantiality and prestige of graduate instruction in the colleges of pharmacy throughout the United States. Therefore, I make a plea that some action be taken along these lines by those in this section who are interested in this problem. Furthermore, textbooks for these courses, both didactic and laboratory, are also needed very much as no satisfactory textbooks are available today. Very acceptable textbooks to be used as adjuncts for graduate instruction would serve a number of purposes.

- 1) Insure the graduate student, irrespective of the college attended, that he would obtain substantially the same course content in these courses.
- 2) Relieve the professor of the tedious duty of attempting to keep such notes adequately complete in so many diversified subjects thus releasing his time to be devoted to more productive efforts.
- 3) Enhance the



prestige of pharmaceutical chemistry. Such books should not be attempted by a single author because I feel a much better job could be accomplished by the cooperation of a number of authors. I therefore make a second plea that some action be taken along these lines by those in this section interested in this problem.

I do not want my above comments to be taken to mean that I believe in rigid standardization. In the courses that might be agreed upon there should be room for flexibility of instruction. These courses, if properly chosen, will lead toward more complete and adequate instruction at the graduate level. It must be kept in mind, however, that not all the fundamental course work for graduate students in pharmaceutical chemistry is given in the colleges of pharmacy. Much of his training is obtained by taking courses in other departments such as organic chemistry, physiological chemistry, etc. Because this training is also very important, a prospective graduate student should choose a university where he can best obtain a complete and rounded education. This will make him better qualified to carry on in his chosen profession.

I sincerely hope that in this postwar period when many in industry are turning out so much "Jerry built" merchandise, that pharmacy will seize this opportunity when so many students want to enter graduate work, to build a foundation in graduate instruction which will have sound, far reaching, and lasting effects. I for one feel that it is a difficult job made more difficult by the very nature of the subjects involved.

The subject of research can be a lengthy one, and I shall not attempt to discuss it in this address. However, the term "worthwhile research" has been used by others with reference to research turned out by the colleges of pharmacy. I think the statement "worthwhile research" should be used very cautiously. Because the results of some research project does not have some immediate and direct application, does not imply that the research is worthless. All the results of research, if carefully conducted and whether the results are positive or negative, are worthwhile. I suppose, by virtue of their calling,

that pharmaceutical chemists should engage in research that will better the profession of pharmacy and medicine. This may primarily be classified as applied research. Some problems may necessitate the development of pure research. However, lest we be too severely criticized by others, I feel that some pure research should come from colleges of pharmacy. One has only to recall some of the discoveries made by such men as Scheele, Serturner, Pelletier, Mueller, Thenard and others in order to realize that pure research bears fruit in more ways than one.

Success in research may come to those who are naturally gifted along these lines or to those whose latent ability is developed by competent training. Research is often slow and painstaking and often tries the patience of the best of men. It should not be looked upon as a field of endeavor in which anybody may engage through some fleeting desire. At times the researcher may be in ecstasy and at others in the depths of despair. But the faithful, diligent and competent are often justly rewarded for their well earned efforts. This may account in part for the inactivity on the part of many professors in pharmacy. We may not have enough of the men who fall in this category. If this be true, let us hope that the colleges of pharmacy through certain attractive opportunities can in the future entice young men who will bring about that which we now so highly desire.

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The cancer information program being planned and carried out jointly by the American Pharmaceutical Association and the U. S. Public Health Service has now reached its third mailing. Over 12,000 pharmacists are now cooperating in this program. Individual pharmacists as well as pharmacy in general are receiving widespread commendation for their assistance in the fight against cancer.

## Pharmaceutical Chemistry at the Graduate Level\*

WALTER H. HARTUNG

School of Pharmacy, University of Maryland

When your committee asked me to discuss the offerings in Pharmaceutical Chemistry to graduate students it was presumed, I am sure, that I would describe the program we have adopted at Maryland. Naturally we are in favor of this program, but it occurred to me that the best criticism might be obtained from former students who have gone through it. Accordingly, I asked these former students to give frank appraisal of the work taken with us and to offer constructive criticisms. I asked for frankness even at the cost of wounded feelings. Now let me establish the competence of these critics.

During the period from 1939 through 1947 a total of twenty-two were awarded the Ph.D. at Maryland, major in pharmaceutical chemistry. Of these, eight (36 per cent) worked on postdoctoral fellowships, four at Northwestern, three at Illinois and one is now at Johns Hopkins. These men have had to compete with others from other universities and, if you will, from other areas of training. I consider it *prima facie* evidence of satisfaction on the part of Northwestern and Illinois when these institutions reappoint another Maryland pharmaceutical chemist to a vacancy created by a former Marylander's leaving.

The twenty-two doctors were employed, at the time of the questionnaire, as follows: Teachers, 8. Among these are one dean, a professor in organic chemistry and a professor of pharmacology.

Research chemists in industry, 10. Of these one is not employed by the pharmaceutical industry. One is engaged in

\*Read before the Conference of Teachers of Graduate Instruction at the 1948 meeting in San Francisco.

what I call pharmacy research. A third was interested in development and production. The remaining seven are engaged in pharmaceutical chemistry, that is, working in a chemical laboratory on problems of purely medicinal chemical interest. These men are competing directly with others, particularly organic majors, from well established graduate schools. I might add that one of the seven is director of research for his company, and another is directing the search for fungicides for the U. S. Navy.

Fellows, 2. Two of last year's men are now getting further training at other institutions.

Librarian, 1. We have had one woman receive the Ph.D. She is now married and serves as an assistant to her husband, who is a dentist. However, before her recent marriage she made literature surveys for the men working in research laboratories.

Retail pharmacist, 1. This man had been employed in industry as a development chemist. It seems that he fell heir to a profitable retail drug business.

These facts indicate the competence of the men whose opinions and criticisms were solicited.

Here, in essence, is the program these former students were asked to criticize. From students majoring in pharmaceutical chemistry we expect the following:

Physical chemistry - a minimum of ten semester hours. This is the course required of chemistry majors, and we consider our students chemistry majors. We expect our students, therefore, to have completed the prerequisites in mathematics, physics, analytical chemistry, etc., before they register for physical chemistry.

Organic chemistry: We expect the student to show considerable proficiency and competence here. He is asked to take courses in advanced organic theory, organic reactions, organic syntheses, organic analyses, etc.

**Analytical Chemistry:** This is the most vulnerable part in our program. I wish we could offer more, but lack of personnel, chiefly, is responsible. However, this deficiency is in part compensated by other courses and the qualifying examination requirements. At the present time we offer no graduate courses labeled analytical chemistry except organic qualitative and some pharmaceutical analysis. Whatever consolation there may be, none of the twenty-two has commented on this lack, except to state that we ought to offer training in instrumental analysis. I agree. But may I add that if we ever do offer a course in instrumentation we'll have to guard against the temptation of making out of our students gadgeteers rather than scientists.

**Inorganic chemistry:** We offer no course here. The lack is not so serious since the student gets much of the material in other courses, e.g., in physical chemistry, study of the rarer elements, atomic structure, etc.

**Pharmaceutical chemistry:** We operate on the principle that the chemistry of things pharmaceutical is no different from the chemistry of other things. Pharmaceutical chemistry isn't a different kind of chemistry. It is the same kind of chemistry as other kinds. Only the immediate interest is different, namely, in things pharmaceutical and medicinal. Hence, during the graduate program at Maryland, greater emphasis is placed on the fundamentals of all phases of chemistry than on the particulars of pharmaceutical products. We feel, for example, that it is more important for the student to know what chemical properties to expect from, say, morphine when he sees its structural formula than it is for him to memorize the formula and the equations for its transformation into say, metapone. A substantial foundation enables the student to grow and build himself "more stately mansions", even after he leaves us.

Thus, the emphasis is placed on basic courses. The pharmaceutical "slant" is provided by:

- a) the environment
- b) the dissertation problem and concomitant library work
- c) the minors
- d) special courses

You will note that I put special courses last. I give two such courses, one each alternate year. The one is alkaloids, the other I call "survey", in which I cover terpenes, carotenes and stereoisomerism. You may say that these subjects are important to a pharmaceutical chemist. I agree. But let's keep the emphasis where it belongs. A student who understands the basic principles of chemistry is going to dig out for himself a better appreciation of alkaloids, or terpenes, or carotenes, etc., than the student who knows only the particulars about alkaloids, etc., is going to appreciate the fundamentals of chemistry.

I trust this adequately explains our objectives, and our courses are organized accordingly. I shall not bore you with the details of titles and credit hours.

Before we will recommend a student to the Graduate Council for Ph.D. candidacy he must, in addition to showing proficiency in the laboratory and course work, pass the qualifying examinations. These comprize four written examinations, each designed to be about four hours in length (an occasional candidate has required eight hours), given on four successive days. These are designed to test the student's overall understanding of chemistry, and the subject matter of the examinations is:

- a) inorganic and physical chemistry
- b) organic chemistry
- c) analytical chemistry, covering inorganic qualitative, quantitative analysis, organic qualitative and quantitative procedures, and official and unofficial methods of drug assay.
- d) pharmaceutical and medicinal chemistry.

Thus far I have said nothing about the minor program of the Ph.D. candidate. He has considerable latitude. He may take a single or divided minor, selecting from pharmacy, bot-



any or pharmacognosy, physiology, bacteriology, pharmacology and physical chemistry. We urge at least a part minor in one of the biological sciences. We do not approve a minor in organic chemistry; to our way of thinking it would be too much like making a minor out of the major. We feel much the same way about biochemistry.

As I said above, twenty-two candidates submitted to that program since I came to Maryland. They are now in active competition, as earlier indicated, with men trained elsewhere, and many are associated with men trained in "other areas", so-called. Here are the comments of sixteen out of the twenty-two. Four others also submitted replies, but their comments are covered by the following and, hence, are not given in detail.

#### Number 1.

"As far as courses on the graduate level or other training goes, I should have liked two things:

1. A course in applied psychology—how to handle people, both superior and subordinate.
2. A seminar on what industry expects in a laboratory which is not a research lab in the strict sense—; e.g., the necessity for investigating the financial aspects of the problem:
  - i) availability and cost of materials
  - ii) necessity for the production of sizable quantities for testing, e.g. 1 to 2 kg. as compared to 10 to 15 grams."

#### Number 2.

"I can say that I consider the training I received at Maryland to be excellent. When I came to Maryland my organic was very weak. In fact most pharmacy schools are weak in organic. Fortunately I picked up my organic by reviewing and by assisting. I can't suggest any other courses to add to the graduate curriculum as it stands. In order of importance I would place chemistry of medicinal products, advanced organic, identification of organic compounds, alkaloids, terpenes. I also wish to emphasize that closer supervision of lab techniques and library use should be instituted in order that time be saved. What do you think of offering a course in 'instrumentation'?"

Number 3.

"May I point out some of the things which I consider strong points of the Maryland curriculum?—The personal contact with the staff which permits that 'old shot in the arm' is a valuable adjunct to one's training. The manner in which organic and pharmaceutical chemistry are taught seems to be excellent, e. g., first a real brush up course as advanced organic, then courses in pharmaceutical, stressing structural development. Some of the examinations still impress me as thought stimulators. While on the subject of examinations, the comprehensives should be required before actual laboratory work (on the thesis problem) is started. I can remember how some of my lab work cleared up when I started studying for my comprehensives.

"Although I have not actually used physical chemistry in my work the fact that I was exposed to (it) has been a definite asset. The actual use of physical chemistry is becoming of increasing importance not only in instrumentation but in a clearer understanding of trace element chemistry and physical structure of molecules and their therapeutic value. At the present time instrumentation is becoming a must. The Pharmacopoeia is turning to instrumental methods of analysis. If you are training men to be in authority in pharmaceutical industry, they must in some way gain a knowledge of these tools. Seminars conducted at Maryland were not on a par with those conducted at . . . . .

"I believe that more importance should be attached to report writing. I found that I get quite a bit out of writing (weekly, monthly and annual) reports; the rehashing of what I have done and the attempt to put it in writing makes me think of things to do that would otherwise go undone. The use of original notes so written as to withstand patent investigation was new and novel to me. It would seem to me that it would be wise to institute some type of laboratory record by the graduate student; this would also apply to the securing of library references. I would like to have had the staff review my working notes and criticize my method of taking these."

Number 4.

"I would like to see more emphasis placed on the physico-chemical properties of medicinal products."

Number 5.

"At neither (of the two places where I worked as librarian) did I experience any difficulties in fulfilling my duties, and I consider

this happy circumstance to be a reflection on the training which I received.

"However, writing as a librarian, I must say that the knowledge possessed by an unbelievable number of chemists on the means of obtaining recorded information leaves much to be desired. Many of them cannot even use the index to Chemical Abstracts constructively. Correct organic nomenclature has been very much slighted. These are conditions of which I know you are aware. However, they appear to be so ubiquitous that I feel that all those in a position to alleviate the confusion should do their utmost. Certainly a few hours on reviewing C. A. organic nomenclature in front of the 1946 Subject Index would be helpful."

#### Number 6.

"The only things are the obvious ones, such as a good background in organic itself at both the undergraduate and graduate levels, something along the line of advanced analytical work, training in thought along the line of new medicinals, and an analytical approach to problems. Training in following thru the thought processes (of the original investigators) on, for example, the structure of penicillin, biotin and many others should develop the reasoning processes apparently being neglected in present day education at the lower levels."

#### Number 7.

"I approve very much of the courses given in alkaloids, terpenes, stereoisomerism and of the advanced organic. I do feel rather strongly that there is need for a course teaching the trends and patterns of the development of synthetic drugs, call it Special Topics for want of a better name, that would give a detailed discussion of chemical synthesis and pharmacological findings that have led to the development of the long series of local anesthetics, pressor drugs, antihistamines, etc.

"Blicke's chapters on antispasmodics in the Annual Review of Biochemistry almost could be used as a section of the course. There should be enough historical development to familiarize the students with outstanding men and developments, and at the same time sufficient reference to acquaint the students with the lists of outstanding review articles should be included. In short this course would be a modernized version of your alkaloid course that treats more recent developments."

Number 8.

This student gave a complete outline, which is given below.

ORGANIC MEDICINAL CHEMISTRY  
AT A GRADUATE LEVEL

- "I. Purpose: To equip a pharmaceutical chemist with the organic and pharmaceutical knowledge essential for advanced work in his field.
- "II. Prerequisites
  - A. Elementary organic chemistry (i.e., presupposing a knowledge of elementary organic synthesis)
  - B. Physical chemistry
  - C. Elementary pharmacology
  - D. Languages
    - 1. German
    - 2. French
- "III. Introduction to organic chemical literature
  - A. List
    - 1. Reference texts and manuals
    - 2. Reference handbooks
    - 3. Periodical literature
    - 4. Other sources
  - B. Assigned topics, closely related to the course involving students use of above literature sources.
- "IV. Suggested points for study of important and/or modern medicinals.
  - A. Correlation of structure and structural modifications to pharmacological activity.
  - B. Structure elucidation of important natural compounds
    - 1. Correct formula (given first)
    - 2. General reactions
    - 3. Degradative reactions
    - 4. Synthetic reactions
    - 5. Other pertinent data
      - a. Physical-chemical data
      - b. Pharmacological data
  - C. Important synthetic reactions
    - 1. Of laboratory importance or use
    - 2. Of industrial importance

## D. List of types of compounds to be stressed

1. Terpenes
2. Alkaloids
3. Amino-acids
4. Vitamins
5. Anti-biotics
6. Hormones
7. Dyes
8. Other important types, q. s."

## Number 9.

"My feeling is that the school of pharmacy located on a campus has a tremendous advantage over isolated schools. A large part of the instruction could be provided in the school of chemistry and offer the student a much broader outlook on the field as a whole. A stronger background in organic, physical and inorganic could be provided. The importance of a good foundation before entering the graduate school should not be overlooked. The medicinal background of the undergraduate pharmacy student offers him several advantages, in some ways he is better off than a chemistry major. I say this because the training in biological subjects is of advantage.

"It has always amazed me that the organic chemist trained in the school of chemistry knows so little of medicinal chemistry and biology. Wouldn't this man benefit from exposure to men thoroughly trained in medicinal chemistry? It is my feeling that we are organic chemists, pure and simple, but with medicinal backgrounds. If we have the good base necessary to organic men, then we have the advantage over them since the minor training offered us gives us a broader outlook on the field."

## Number 10.

"For a well rounded curriculum of organic medicinal chemistry the following should be included.

"1. Advanced organic chemistry—the course should include the most recent reactions and theoretical aspects of organic chemistry. Emphasis should be placed on the medicinal use of various classes of compounds, and a correlation of physiological activity with chemical structure should be made wherever possible.

"2. Stereochemistry—relative configuration, cis-trans isomerism, restricted rotation, etc. should be discussed and here again emphasis on medicinally useful compounds would be desirable.

"3. Terpenes and sterols.

"4. Alkaloids.

"5. Heterocyclic compounds.

"6. 'Chemomedicotherapy'—this course could be extremely useful for a man engaged in medicinal research. Perhaps the best plan would be to make this a seminar course and have each graduate student take the course every year. Every important field of medicinal agents would be surveyed and mimeographed copies supplied to each student. The seminar would give the student wonderful experience in searching through the literature, and the mimeographed copies of the report with all references listed would give every one a valuable bibliographical summary for these several fields of medicinal agents.

"Speaking as a humble chemist who is engaged in the attempted synthesis of compounds intended for a specific medicinal use, I feel that I am not prepared to tackle my job in the most efficient manner possible. Here is what I mean. Say, for example, that the research program of interest to my company is in the field of antibacterial compounds. What is usually done by me is the following: A literature survey puts me up to date as to compounds possessing antibacterial properties. The mechanism of action of these compounds, if discovered, is likewise recorded in order that the compounds that will be synthesized might exert their effect similarly. No matter how I apply my training or how well I survey the literature, the compounds I prepare are still shots in the dark. The philosophy in medicinal research seems to be that you should try and see if it works. Instead it should be: Why does it work? If I could have a training which would enable me to study the mechanism of action of medicinal compounds, it would seem to me that the following courses would have been among those given: biochemistry, physical organic chemistry, thermodynamics, statistics."

#### Number 11.

"Looking back to my graduate training, I think that mine was excellent. What especially convinces me of that are comparisons I can frequently make with the more than 100 PhD's I work with—most of them from the so-called high pressure schools like \_\_\_\_\_. If you want my suggestions for improvement of the curriculum, here they are:

1. A course in sterile, synthetic chemistry to result in pyrogenfree products.
2. Eliminate some of the less important syntheses in the alkaloid and terpene courses.



3. Stress applications of general reactions in much the same manner as Adam's 'Organic Reactions'.
4. A stronger pharmacology minor.
5. Instruction on the proper keeping of research notebooks sounds silly, but I don't believe that most know how to keep complete notes, especially in the eyes of the patent attorneys."

#### Number 12.

"Unfortunately, the term 'pharmaceutical chemist' has two separate and fairly distinct interpretations entirely dependent upon the individual who has directed the graduate in his doctorate work. Broadly speaking, he is an 'organic' man with a pharmaceutical background or a 'pharmacy' man with a chemical background. In my case, both as a post-doctorate with (Professor . . . . .) and here at . . . . . Laboratories, I have been in constant competition with straight organic majors. Frankly, I feel that I was considerably handicapped at the beginning. Lack of familiarity with equipment and laboratory technique was immediately apparent. This was essentially overcome by the (post-doctorate) year. The rest has been a slow 'catching-up' of some of the straight organic background. To remedy the situation, as regards the theoretical background of the pharmaceutical chemist in basic organic chemistry, is impossible without increasing the curriculum and thus making the pharmaceutical chemist a 'super' organic chemist, that is, a straight organic major with additional courses in pharmacology, pharmacy, etc. However, with very little difficulty and expense, any pharmaceutical chemist could be as fine a laboratory man as the organic chemist in performing the same tasks."

#### Number 13.

"I have come to the conclusion that the Ph.D. from a pharmacy school is of value only when the degree is taken in pharmacy—not pharmaceutical chemistry. After all, who in the 'first ten-ers' in the field of medicinal chemistry has a pharmaceutical background?"

"I am well qualified for the position I now hold, but if I had the opportunity to relive my graduate days, I would arrange the following modifications:

1. A course in patent law for chemists.
2. More intensive work in organic syntheses.
3. Less emphasis should be placed on minor subjects, courses in pharmacology, physical chemistry, etc. In industry a research chemist is not asked to test his compounds physiologically; pharmacologists are available for this work. Why are such courses emphasized as minors?

4. A course in industrial chemistry would be helpful, something to prepare the student for the change from academic interests to those characteristic of industrial houses.
5. A post-doctorate fellowship—in another university."

Number 14.

"I have no criticism with the graduate courses which were offered to me in chemistry. There is one course that I believe the boys in your graduate study should have which I don't believe you offer. I was lucky enough to be able to audit such a course during my post-doctorate. I refer to a course in name reactions where they are studied from the angle of grouping all reactions together which link carbon to carbon, carbon to oxygen, carbon to nitrogen, etc.

"The other thing I would like to see—is a course or courses offered which would give the student a complete background on each and every type of compound that is used in pharmacy and medicine. You do that of course in the field of amines, but take for example the antispasmodic field. There the student should be given the historical background of the papaverine group and atropine, told of their desirable features and their shortcomings, shown what has been done in the alteration of these two compounds to find better ones, shown what appear to be desirable changes and what are undesirable, told which products are in use in the field, why they are being used and also—what they need for improved action.

"If this complete picture were given to the student for local anesthetics, antispasmodics, analgesics, cholinergics, antibiotics, etc., then when he started with a job with a research staff he would not have to mark time and work on other people's ideas until he had built up sufficient background to start submitting new ideas in the particular field.

"I realize that a great deal of this material is presented in various courses, but I believe it would be more beneficial if presented in the manner just described. I will elaborate a little more. When I started on my antispasmodic program I of course knew of papaverine, syntropan, tresentin and pavatrine, but before I could decide what should be tried I had to do a study of all review articles on antispasmodics and a literature search to discover all that had been done in the way of altering the acids, the amino alcohols, the isoquinolines and open models of papaverine, what changes had improved the molecules and which had not. I also had to read the pharmacology books to find out why the popular compounds are used by the M. D.'s and what they lack and how they need to be

improved. Only then was I able to think of new ways to alter the structures to get the new activity desired. I believe all this could be given to the student in fairly condensed form so that after he left school he would only need to keep this information up to date as time passed. In these reviews the chemistry of patents should be stressed.

"I find that our patent files, classified according to pharmacological activity, are an excellent source of information not only for finding out what has been done but for offering suggestions for new things."

#### Number 15.

"First, our graduate training is mainly along the lines of classical, descriptive, organic chemistry. Whether we like it or not, organic chemistry rapidly is becoming more than a descriptive science and one hardly reads a journal article in which concepts of electronic interpretations are not applied. Thus, I feel that our present program profitably could be rearranged to include sound courses in modern chemical theory along the lines of Watson, Hammet, Remick, Wheland, Branch and Calvin.

"Second, our present training in physical chemistry is inadequate. The one course which we receive is not enough. Advanced work should include physical organic chemistry with special emphasis on the techniques and methods which are available to the organic chemist for his elucidation of more complex problems; certainly the use of a spectrophotometer, the fluorimeter, etc., should be familiar to the well-trained organic chemist.

"Third, I personally feel that a sound training in quantitative analysis, especially the micro techniques, would strengthen the present curriculum. How unfortunate that we do not have the opportunity to run a single elemental analysis, upon which most of our structural organic geometry is based!

"Finally, there are a host of minor changes, which reflect my own inadequacies and (are) not the fault of the curriculum. These include a more assiduous attention to note-taking and a broader view of the library facilities (such as microfilm, A. S. C. photostating service, use of the Search Room in the Patent Office, etc.). I frankly don't know how such information could be presented to the student (perhaps in seminars?) but the present unorganized methods are unsatisfactory."

Number 16.

"My experience at the \_\_\_\_\_ Research Laboratory indicates that your students can more than hold their own against a very large number of extant chemists. But having suffered a rather violent transition (into the role of a post-doctorate fellowship), I might add that some schools seem to be turning out men quite superior to us from Maryland. Excepting the difference in student ability, which probably exists, the main advantages of the big time school seem to be simply industry and alertness. The students here work extremely hard. They are given great quantities of problems and library research to do and are apt to be tested on it along with lecture material. Tests involve thought-questions rather than parrot-questions and presume upon a knowledge of other subjects. The result of this professional attitude is that the students realize they are here to learn a subject rather than to pass single, limited courses, and they do not complain if they are examined on their knowledge of chemistry rather than on their ability to recite lecture notes blindly.

"There is an all-pervading air of alertness here which springs from the professors and infects all the students. Journals are read and discussed as soon as they appear and students planning research or seminars write men in their fields and get pre-publication data. Patents and industrial processes are known and there is no avoidance of reactions or articles involving heterocycles or polycycles—all is grist for the mill, and it grinds exceedingly fine.

"Then, too, it is time (well past time really) that every one interested in organic chemistry buckle down and learn the electronic theories. Most of my deficiencies, I believe, I can overcome by study, but theoretical organic chemistry looms large and dark in my dreams. I don't suppose it's really very hard; it's just that it should be learned along with all the other facts of organic chemistry because it is an interpretation rather than an extension of our knowledge.

"Perhaps some specific suggestions (will be) more useful to you:

- i) Teach electronic interpretations of organic chemistry.
- ii) Presume a knowledge of elementary organic chemistry and teach Chemistry of Medicinal Products in a broader and deeper sense of the physiological activity of organic compounds, rather than simply a discussion of those compounds currently in vogue as drugs. I do not mean, of course, to omit the synthesis and properties of complicated drugs, or any reaction peculiar to them. Correlation of structure and activity is of utmost importance.

iii) Give lectures in organic qualitative analysis, including lectures on general laboratory technique as found in Morton's book on technique.

iv) Give instructions in the use of the literature and in approaching research problems of various types. Discuss value and limitations of patents.

v) Require the seminars to be based on current Chemical Abstract papers, but involving literature searching for previous work on the subject. There should be separate seminars in chemistry of medicinal products and organic chemistry.

vi) The following would be desirable if possible:

- a. Glass blowing instruction leading to real proficiency
- b. A course on the biographic history of chemistry
- c. Emphasis on commercial and industrial aspects of organic chemistry
- d. Practical instruction in electronics and electricity, involving knowledge of all instruments now in use by chemists

vii) Instill in the students a confidence that what they are learning is as new, as advanced and difficult, and as thorough as that which even the largest schools give their students. Encourage the use of unusual or new reactions and equipment, even though some danger might be involved. Encourage the study of reaction mechanisms and variations in reactions based on such study. Expect more than they can give you, and make them aim for the moon. I've noticed that even dullards can work and are the better for it. Demand a professional and industrious atmosphere."

I do not know what impression you have, after hearing these comments, of our program. That is not my concern at this time. I think you will agree that the comments are pungent and, coming from men who have had opportunity to compare themselves with others of supposedly equal training, that they merit attention. I might add that many sent in criticism of departments other than chemistry, but I did not feel at liberty to include these.

It is unnecessary for me to amplify on the remarks that our former students have made. Some of the recommendations vary from the Utopian to the practical. I don't want to "defend" ourselves against some of the sins of omission and

commission which they imply. I want merely to summarize the general impressions that I obtained from the letters and from the discussions.

1. The general objectives of our program are acceptable.
2. In the fundamental science courses there is greater need for further offerings in theoretical organic and physical chemistry.
3. There is little demand for revision of the pharmaceutical chemistry offerings; the demand is rather for more basic courses in order that pharmaceutical and medicinal chemistry, as special applications of chemistry, may be better understood.
4. No recommendations for a change in the minor programs were made (except for the one man who questioned the minors). Strong, general approval is voiced for pharmacology as part of the minor.
5. The suggestions respecting literature surveys, reviews of patents, seminars are much to the point, and these matters deserve careful early consideration.
6. Recommendations are made for practical courses and offerings have considerable merit, but they are not basic and hence should be accepted as electives. The discreet major professor will know where to draw the line.

**Discussion, Charles W. Bauer, Massachusetts College of Pharmacy.**

—Teaching pharmaceutical chemistry at the graduate level is a relatively new assignment for many schools. The problem of giving the graduate student in pharmaceutical chemistry a well-rounded program of study under competent and learned instructors, however, is not peculiar to these schools alone, as Dr. Hartung's paper points out.

The Committee on Pharmaceutical Education at the Graduate Level was fortunate to get Dr. Hartung, an experienced teacher and research worker, to give us an analysis of this topic. He has made a unique approach to this theme, and as he puts it, "at the cost of wounded feelings" in order to get an honest and accurate picture from those who are most vitally concerned to evaluate our teaching. The criticisms he received were, however, very complimentary and left little room for wounded feelings. The adage that "blood is thicker than water" seems to hold true here. The specific gravity runs so high in places that one suspects a trace of hyperglycemia.



You may feel that Dr. Hartung's picture of this theme could stand a little more coloring along the borders and that a heavier pigmentation might have been accomplished if he had sent his questionnaire to twenty-two doctors of pharmaceutical chemistry in each of twenty-two additional schools. And you might add that at least 8 of these graduates must be engaged in teaching and 10 must be employed in industrial research, and that all of these graduates must have received their degrees within the past 8 years. You know why Dr. Hartung didn't and why he couldn't do this. Hence, we will benefit materially if we will take the criticisms and the suggestions he did get from those having the degree of doctor of philosophy in pharmaceutical chemistry as being typical of our own schools. If anyone does not agree with this point of view he is at liberty to send out his own questionnaire and prove us wrong.

If you feel as I do then you are in agreement with most of the points Dr. Hartung has made with minor qualifications. May I point out a weakness in the validity of some of the criticisms that should not be allowed to pass without comment. You have found, I am sure, as I have that many of our graduates who are not in the teaching profession little realize that the material taught, in practically every subject in chemistry, is not a static program. We know that the subject matter in every course requires frequent revision and that this is being done, even though the name and number of the course, and the teacher, are not changed. Many of our alumni think that we are teaching the same things in the same way we taught them when they were in school. I once heard a man lambast his alma mater for failing to teach him all about the vitamins when he was in school some thirty-odd years ago. I am relatively sure that some of the changes that Dr. Hartung's students have asked for have been made and were actually in operation long before he received these suggestions.

On the other hand many of the criticisms are in the form of good suggestions on which action has not been taken. It behooves us to give these criticisms our best consideration in order to improve the quality of our teaching.

The suggestion that we have more and better seminars in which all of the graduate students and faculty in the chemistry department participate is an excellent one. This point impressed me very much since it has received so much attention by my immediate associates. We are agreed that there is a big difference in the quality of seminars. Seminars can and should be placed on a high plane of learning.

A second suggestion not to be ignored concerns the graduate who goes into industrial work. He feels that he has not been given sufficient training in the commercial and industrial aspects of pharmaceutical chemistry. To the graduate these fundamentals are just as real as a neutralization equation. One way to correct this deficiency in teaching pharmaceutical chemistry at the graduate level is to supplement our faculties with teachers who have had adequate industrial training. Our deans are aware of this deficiency in our teaching and are doing all they can to correct it. We wish them more and more luck in this department.

A third suggestion is a cross between a complaint and a demand. Our graduates complain of inadequate training in note taking and in making literature surveys. This, as one graduate puts it, "sounds silly" but nevertheless it is true. Putting the blame on the high schools or the undergraduate education does not solve this weakness. A more realistic approach must be made to this problem. Let us put the blame where it belongs and admit that this weakness will be strengthened when we teachers learn more about it ourselves. Then and only then will we be able to correct this deficiency in our teaching.

There are several other points we should discuss but I will limit my time to just one more suggestion. A suggestion that came in the form of a complaint. Dr. Hartung's former student was thankful for the individual attention he received while in school. He spoke of the value of close contact between student and faculty. Frequent consultations and progress reports are one way to bring out this attention that is one of those intangibles so hard to evaluate but which is so necessary to the graduate student. I call attention to this point because I am afraid that the increase in the number of graduate students is apt to increase the teacher's load so much that he will be unable to give the graduate student the attention and the time, which is not scheduled, that he has been able to give in the past. Teachers of graduate students must arrange to have frequent consultations and progress reports. This keeps up a sympathetic interest and helps many discouraged research worker make a brilliant finish.

In conclusion, may I compliment Dr. Hartung for bringing us an excellent analysis of the problems that face us in teaching pharmaceutical chemistry at the graduate level. We have been helped in finding better and still better ways of carrying out this assignment.

## Graduate Study in Pharmaceutical Chemistry at College of Pharmacy, University of Washington\*

LOUIS FISCHER AND LOUIS ARRIGONI

University of Washington, Seattle

Graduate study in a college or school of pharmacy presenting advanced degrees is usually offered in one or more of the four generally classified divisions, namely: pharmaceutical chemistry, pharmacy, pharmacognosy, and pharmacology. The various divisions of graduate pharmaceutical education are comparable to those in other allied branches, in that the respective fields are so broad that no one individual is capable of mastering the intricate details of each. The candidate, however, by proper selection of advanced courses and research problem, is able to specialize in a desired field. The choice of major, minors, or supporting subjects requires serious consideration and sound planning. Two objectives should be borne in mind in the selection of these courses, first, the interests of the candidate and second, proper training in the desired field.

In the field of pharmaceutical chemistry, a trend has become increasingly evident directed toward still further specialization within its scope. This has been in part activated by the arbitrary tendency to subdivide the field into three divisions: 1) the synthesis of organic compounds of therapeutic usefulness, the study of their properties, and methods for their identification and assay; 2) pharmaceutical engineering, a field requiring a thorough knowledge of pharmacy and chemistry, together with the engineering ability to manufacture drugs on a commercial scale; 3) phytochemistry, which has contributed greatly in producing purified plant constituents and antibiotics for use in medicine.

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\*Read before the Conference of Teachers of Graduate Instruction at the 1948 meeting at San Francisco.

Although this trend toward specialization within the field of pharmaceutical chemistry is apparent to us as well as to most other workers in this branch of pharmacy, we feel that in many cases the training offered to graduate students has been overly specialized. As a result some of these candidates have not been given the minimum background in the basic science fields necessary for the implementation of their future work in the field of pharmaceutical chemistry as a whole.

This lack of thorough training in cognate and allied branches of science is not as disadvantageous to the individual whose work, following the completion of his graduate study, is restricted to research in the narrow field in which he was trained under the supervision of an adequately trained director. However, it becomes a very serious impediment to those who are placed in positions requiring the guidance, supervision, and planning of research projects, and especially to the large number of advanced degree recipients who are called upon to teach chemistry in pharmacy schools.

Obviously it is impossible to specialize the training in pharmaceutical chemistry to the extent that the schools will have the opportunity of selecting instructors in pharmaceutical chemistry who have concentrated their efforts in any one of the divisions or branches of chemistry taught in pharmacy (with the possible exception of organic chemistry).

With this in mind we feel that students preparing for the doctorate in pharmaceutical chemistry should be required to take advanced training in most, and preferably in all, of the branches of chemistry he may be called upon to use either in teaching, industry, or research. In following this course of action, it is the responsibility of his major professor to make certain that the student is not merely superficially trained in a variety of fields, but is, at the same time, thoroughly or specially trained in some aspects of pharmaceutical chemistry. By placing emphasis on the proper subject material and choosing the candidate's research in line with his chief interests, the resulting recipient of a Ph.D. in pharmaceutical chemistry will

be capable of coping with the obligations of most positions available to him.

To press the point of diversification of instruction still further, we feel that a graduate student should not only broaden his scope of learning as much as possible but that he should also come in contact with as many different professors in as many departments within his and allied fields as possible. In this way the finished student will reflect the teaching, attitudes, philosophy, thinking and to some extent the abilities of a variety of leaders in their respective fields rather than only those of his major professor and perhaps one or two members of the same department.

We have found at the University of Washington College of Pharmacy that the academic and research interests of graduate students in pharmaceutical chemistry fall into five fairly well defined patterns:

- 1) Synthesis of organic compounds of possible therapeutic significance.
- 2) Synthesis of organic compounds along with their pharmacological evaluation.
- 3) Phytochemistry
- 4) Preparation for analytical, industrial control, and food and drug work.
- 5) Pharmaceutical Engineering.

In order to embody the philosophy of teaching that we have outlined in the preceding paragraphs, the Pharmaceutical Chemistry Department at the University of Washington has established an academic regimen for its graduate students, which allows for both diversification of over-all training and specialization within each of the five lines of interest enumerated above.

These advisory programs are built around the requirements of the Graduate School as a nucleus and consist of 45 credits of work in allied or cognate fields as a minor,

45 credits in the major field including courses in instrumentation, special techniques, plant principles, etc., and 45 credits of thesis research in the field of major interest.

In general, the choice of course work in the minor and major fields but especially in the former is predicated upon the student's choice of the five categories listed above. However, the courses are chosen on a broad base in order to thoroughly train the student in the fundamental concepts necessary to carry on integrated research or to teach in the various fields of chemistry encountered in the pharmaceutical curricula.

The selection of the student's thesis research is made jointly by the student and this professor in charge. The thesis research is chosen to fall within the scope of his acknowledged interests, preparation, and capabilities.

In addition to following the above advisory programs we have reorganized bi-weekly seminars, attendance at which is compulsory for all graduate students in pharmaceutical chemistry. The participants in the seminars, is not confined to graduate students in pharmaceutical chemistry but includes students and faculty from all the divisions of pharmaceutical research and from as many allied fields as possible.

These seminars, when properly organized to encompass a wide variety of allied fields of learning, provide a very valuable type of training to both the students in the audience and to those presenting the topic of the day.

The student making the presentation accrues the following benefits:

- 1) Development of technique in organization of heterogenous material into a concise, well-organized and instructive talk and paper.
- 2) Development of a keener appreciation of the usefulness of the library as well as an improved ability to use its facilities.



- 3) Practice in speaking on subjects of scientific interest before a critical audience as well as the experience of learning to present clear and authoritative answers to the scientific cross-examination following a presentation.
- 4) Practice is acquired in writing scientific abstracts or papers when these are distributed to the members of the seminar.

The student in the audience receives two definite advantages from seminars. First, he develops a facility for critical attention, secondly, and extremely important, he is kept informed of current and past research both in his specialized and allied fields.

The foregoing points out quite clearly that one of the most valuable instruments of instruction for graduate students is the diversified type of seminar, not only from the standpoint of the training they receive, but also from the point of view of the wide scope of information presented in their own and cognate fields. It is almost impossible for any single individual to obtain a similar breadth of knowledge in any other way.

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The John Hopkins Hospital, in cooperation with the Graduate School and the School of Pharmacy of the University of Maryland, announces that internships in pharmacy will be open to a number of 1949 or other recent graduates of recognized schools of pharmacy. Appointments will be for a period of two years, beginning July 1, 1949. During this time, interns will devote one-half time to hospital pharmacy work and one-half time to graduate study. Upon satisfactory completion of the internship and the course of study, Master of Science degrees will be conferred by the University of Maryland and Certificates of Internship will be awarded by The Johns Hopkins Hospital.

An allowance of \$100 per month will be provided by the hospital, and the University of Maryland will make a reduction of 25% in tuition fees. Complete information regarding fees and curricula can be found in the catalog of the School of Pharmacy, copies of which may be secured by sending requests to the school at 32 South Greene Street, Baltimore 1, Maryland.

Applications for appointment should be forwarded to Edwin L. Crosby, M. D., Director, The Johns Hopkins Hospital, Baltimore 5, Maryland not later than April 1, and appointments will be announced on or before May 15, 1949.

## The President's Page

A number of years ago the American Association of Colleges of Pharmacy recognized the need for a careful examination and appraisal of pharmaceutical education. After thorough study and planning, it was found that such a survey was beyond the scope and the financing of the Association. However, with the support of other national pharmaceutical organizations The Pharmaceutical Survey was started with the appointment of The Committee on The Pharmaceutical Survey by the American Council on Education in June, 1946. Since that date, the American Association of Colleges of Pharmacy and the member colleges have looked forward to the published reports, and particularly to those relating to pharmaceutical education in order that the recommendations could be implemented as soon as might be possible.

Early in December, the "Findings and Recommendations of The Pharmaceutical Survey 1948" were placed in the hands of the faculties of the colleges of pharmacy and were made generally available. A number of the recommendations require action on the part of the American Association of Colleges of Pharmacy for their implementation. For this reason the Fiftieth Annual Meeting of the Association will be a most important one, and although the meeting will be held while the colleges are in session, it is essential that each member college be adequately represented.

Each member college should, through their college faculties, study each of The Survey Recommendations which necessitates action by the Association, and the official delegate must be empowered to act in accordance with the views of the faculty of the college which he represents.

Recognizing the importance and the need of thorough study of The Survey Recommendations, the Executive Committee at the December, 1948, meeting directed Chairman

Burt "to appoint Sub-committees for the purpose of studying" these recommendations. The Chairman of each Sub-committee is a member of the Executive Committee but the members are not so limited. These Sub-committees are to report to the Executive Committee at a meeting to be held just prior to the annual meeting. After studying the Sub-committee Reports, the Executive Committee will make its recommendations to the Association.

With considerable time available for the study of The Survey Recommendations by these special committees and by studies made by the individual college faculties, a minimum of time should be necessary for prompt action toward implementation at Jacksonville, Florida, in April.

May I again stress the importance of having each member college represented at the Annual Meeting April 24-26, and it is our hope that each of the faculties will be well represented.

*J. Lester Hayman*

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## New in the Family

**Bonnie May Goldner.**—Born October, 1948, daughter of Dr. and Mrs. Karl Goldner, University of Tennessee School of Pharmacy.

**Nancy Kay Desmond.**—Born December 19, 1948, daughter of Mr. and Mrs. Desmond Gibson, School of Pharmacy, University of Kansas.

**Kenneth Arnold Dodds.**—Born November 14, 1948, son of Dr. and Mrs. Alvin Dodds, School of Pharmacy, Medical College of the State of South Carolina.

## The Editor's Page

Now that the findings and recommendations of The Pharmaceutical Survey have appeared in printed form, the body pharmaceutic has placed before it a challenge that has not been equalled in any field of professional education, and may I be so bold as to include the field of general education, in modern times. Now that some of the traditional shackles limiting pharmaceutical education have been broken and a new horizon has been set, we are free to build the pharmaceutical curriculum that will best meet the challenge of the new horizon. After sixteen years of trying to improve the curriculum by deleting from or adding to or shuffling within the four year area, there are apparently those who have found themselves unable to delete any nonessentials, because there are none; and we have not been able to add new courses, because there is no place for them; and the shuffling has not produced a better sequence of courses.

The findings of The Pharmaceutical Survey seem to have settled two points without a doubt. First, that if the profession is to continue to be a "vanquishing" profession, the curriculum must be extended to meet the needs of modern medical practice, and secondly, the basic and cultural courses must be extended to enable the pharmacist to cope more effectively with the problems of citizenship. Any suggestion that intimates that these objectives can be attained by reshaping the present four-year curriculum is comparable to giving a baby a dose of paragoric to sooth his abdominal pain. It in no way gets at the basic cause of the colic, or brings permanent relief.

The whole tone of the findings of The Pharmaceutical Survey points toward the necessity of extending the time for both basic and professional studies. There is no better justification for so doing than is expressed almost dramatically in Tables I and II of the admirable and comprehensive report of

our Committee on Curriculum, which appeared in the October 1948 issue of *The Journal*. In Table No. I, the committee tabulates a proposal for a four-year curriculum. The course of study outlined in this curriculum is practically the one which is standard in the accredited colleges at the present time. Table No. II gives a list of subjects which the committee considers as "necessary A," or "desirable B" which should be added to meet the needs of modern pharmaceutical practice. The "necessary" list includes twelve additional subjects, and the "desirable" list names sixteen. If the committee is right, and we think it is, it does not require an individual with a super intellect to see that the problem now is essentially a matter of time, and the best integration of courses so as to make the teaching most effective.

In the other health professions—and in law—the general pattern of the arrangement of the cultural and the basic courses has become pretty well fixed. The grouping of these courses under the headings of pre-medic, pre-dental, and pre-law, and the requirement of their completion before entering upon the study of the professional courses, has become traditional. We have been anticipating the following of this traditional pattern in pharmacy when the time came that the period of training would be extended. In this issue of *The Journal* under the title of "The Organization of the Pharmacy Curriculum," Dr. Earl J. McGrath discusses the wisdom of integrating the cultural and basic courses with the professional ones over a six-year period, rather than following the traditional segregation according to the two—four year plan. Dr. McGrath discusses the advantages and disadvantages of the two plans, and it is evident that the advantages of the integrated plan far outnumber those of the segregated. We have a living example in our present four-year course of the soundness of the principles Dr. McGrath is advocating. Many schools do not give a course in beginning pharmacy in the freshman year. Even the proposed four-year course suggested by the Committee on Curriculum does not suggest it.

There are some of us who have insisted on giving a course in fundamental principles and pharmaceutical preparations,

including laboratory work, in the freshman year. Such a course can be given without chemical preparation. However, the student takes a course in general chemistry concurrently, and he realizes in his elementary pharmaceutical study that a knowledge of chemistry would be helpful to a better understanding of pharmacy. He does not have to be told that—he sees it himself—and it stimulates his interest in chemistry. I have never yet seen a student showing great interest in so-called pharmaceutical mathematics (which is eighth grade arithmetic) when it was carried as an independent subject. But, when he sees that a mathematical procedure is necessary in the simplest pharmaceutical manipulation, his interest in the study of mathematics is stimulated. We have also seen that the students' interest in the study of English is increased when he learns for himself that the study of pharmacy requires exactness in expression, and the ability to express his thoughts clearly and write them with precision.

Dr. McGrath calls attention to the motivation of the student by creating an *esprit de corps*. This motivation is created when he enters the professional studies proper, and when he comes in contact with the professional faculty. In our own experience, we have found that the students most difficult to motivate with the professional spirit are those who come to us as transfers from other colleges—especially junior and teacher colleges—and who are seeking a short cut to a professional career. Happy will be the day when we grant no credit for work done in other colleges toward a professional degree. Medicine learned that lesson a long time ago.

Dr. McGrath's studies deserve the highest consideration in our efforts at curriculum building. The College of Liberal Arts may have made another far-reaching contribution to the improvement of the pharmaceutical educative process.

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If we were to bestow a prize for the most inane statement made about pharmaceutical education in 1948, it would go to the man or men who said that a four-year course is sufficient for the practice of retail pharmacy, but that a six-



year course is necessary for those who wish to go into research or manufacturing or an educational career. Such a statement is equivalent to one that a medical man might make which would read—"A four-year course in medicine is sufficient for a doctor who wishes to practice general medicine in the country, but a six-year course is necessary for those who wish to practice in the city, or who wish to go into a specialty." We have never heard a doctor make that statement, nor have we seen it written in medical literature. As a matter of fact, medical men hold that the people who live in the country are entitled to the same scientific treatment as those who live in the city, and, as a matter of fact, the general practitioner requires even a more comprehensive training to give his patients scientific treatment than the doctor in the city, for he has to perform all kinds of services, while in the city the patient automatically turns to the specialist, whether it be for a hayfever test, a circumcision, or an amputation of both legs at the hip joint. Exactly the same situation applies to the pharmacist. As a matter of fact, the retail pharmacist in a one-man store requires a superior knowledge in order to serve his community in a professional way than that of the man who works in a cosmopolitan center where stores are departmentalized, and where the individual is confined to a limited field and too frequently is told what to do. Then he becomes a cog in a machine. Furthermore, we are clamoring these days for a type of education for the pharmacist that will better prepare him for the *responsibilities of citizenship*.

Certainly, if there is anyone in the whole field of pharmacy who should need training for these responsibilities and for forceful living in community life, it is the retail druggist rather than the laboratory worker or the prescriptionist who spends all his days in the protected confines of a prescription department, for whether he wants to be or not, he is a gregarious animal. In other words, the purpose of the longer educational program in pharmacy is primarily for the purpose of preparing the retail pharmacist to meet the requirements of the new horizon which has been set by the forward sweeping developments in the medical sciences. The suggestion that the four-year course is sufficient for the retail pharmacist

has the odor of arising from that group which is looking for merchandising outlets rather than the improvement of pharmaceutical service. It might be that better outlets could be found by improving and extending the cultural and professional training of pharmacists.

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In these latter days, when we are all fighting valiantly with our lips against the socializing of the health professions, but voting for an administration that declared as one of its major objectives the doing of that very thing, it is not surprising to find those among us who are so lacking in vision as to advocate the elimination of the one-man store. Perhaps this is justifiable in metropolitan cities. In the West, however, we don't all live in such cities. Take Montana, for example, which is a typical western state. There are 240 drug stores in Montana. Only 3 of these stores employ 4 pharmacists; 13 employ 3; 65 employ 2; and the other 159 have one registered man. These 159 one-man stores are the salvation of pharmacy in that state. Eliminate them and the vast stretches of the state would be without pharmaceutical service, and that territory would become the happy hunting ground for the patent medicine vendor. In this western country, we have seen great stretches of country abandoned by the physician, and the quack has taken his place. This lack of medical service in these areas has driven the people to clamor for socialized medicine, because in it they see the hope of obtaining some kind of medical service for the communities in which they live. We can easily add fuel to the fire by eliminating the drug store. It would also limit the outlets for the manufacturer.

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One by one, with the passing of the years, men who have been the kingpins of pharmaceutical education are entering other fields of service. Charles W. Johnson was not only a kingpin of pharmacy in the state of Washington and on the West Coast, he was a pillar of pharmaceutical education throughout the nation for a period of half a century. Quiet in demeanor, self-effacing in all his actions, yet he lived one of

the most forceful lives of our times. When Charles W. Johnson was in the huddle, there was the assurance that pharmaceutical education was on the march. It always turned out that way. We shall cherish his memory and be grateful for his service.

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Too little notice has been given to the passing of many good women who have contributed through their husbands or otherwise to the advancement of pharmacy in our time. Three such helpmeets have died in the latter months of 1948. Mrs. Helen Louise Boerner, a life-long resident of Iowa City and the widow of former Dean Emil J. Boerner of the State University of Iowa, died at Iowa City in December at the age of 89. Dean Boerner was largely responsible for the establishment of the College of Pharmacy in the University, and was its first dean. Besides being the wife of a pharmacist, Mrs. Boerner's oldest son, her son in law, and her brother are all pharmacists.

Mrs. Charles E. Mollett, the wife of Dean Emeritus C. E. Mollett, who was the first dean of the School of Pharmacy of the University of Montana, died in July, and Mrs. L. D. Havenhill, wife of Dean Emeritus L. D. Havenhill, who served a long period as the second dean of the School of Pharmacy of the University of Kansas, died a few weeks later. Those of us who have had the privilege of being in the homes of these good women are appreciative and grateful for their lives of service.

*Rufus A. Lyman*

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The University of Minnesota announces that there are now available four teaching assistantships in pharmaceutical chemistry, three in pharmacy, and two in pharmacognosy. For information, address the Dean of the Graduate School.

## Gleanings from the Editor's Mail

My attention has been drawn by references in an article, which is to appear in the forthcoming issue of the **Journal of Legal Education**, to the many respects in which journals in two fields of professional education can be useful to each other.

We should like to see the **American Journal of Pharmaceutical Education** regularly, and we should appreciate being placed on your mailing list. We should be happy in turn to send the **Journal of Legal Education** to you regularly if you so desire. No doubt there are other ways in which we can cooperate in the publication of these periodicals. If so, we shall be eager to take advantage of them, and we assure you of our willing cooperation with you at all times.

Editorial Offices  
Duke Station, Durham, N. C.  
October 27, 1948

Brainerd Currie  
Editor

Thanks very much for the attention given my letter (Vol. 12, No. 3). I did not think of it being published in such a reputable journal as the **American Journal of Pharmaceutical Education**. The **Journal** is really interesting and our students and the faculty especially read it assiduously.

Our enrollment this year reached 1,950. About 500 more than last year. Three hundred more were rejected because of space. My best wishes for the forward march of the **Journal**.

University of Santa Tomas  
Manila, P. I.  
October 15, 1948

Fr. L. Rodriguez, U. P.  
Dean

I am glad to inform you that on November 23, the government of India in the Ministry of Health appointed an Indian Pharmacopoeia Committee. It is the first time a permanent committee has been appointed by the government. Being entirely new in this kind of work, the officers in the Ministry nominated persons who are known more as administrators than as workers possessing special knowledge in the various pharmaceutical fields. Since it is the first attempt, we are hoping that the officers in the Ministry will soon see their mistake and rectify it so the committee will be more representative and useful.

The Pharmacy Act of 1948 is also being enforced by the central government, and the constitution of the Central Council of Pharmacy is also complete. We expect the announcement of the entire personnel sometime early next year. The provinces, of course, are going very slow and, so far, none of them have enforced the Act. But with its enforcement by the central government, the provinces will have to fall in line. As soon as this happens, pharmaceutical education will get an impetus in this country, and will make much more rapid strides than in the past.

The Drug Act, also, according to an Indian government communique, will be enforced strictly from April 1, 1949. Up to this time there has been no control over patent and proprietary medicines, but now there will be. The events mentioned above are among the most important of those occurring in the pharmaceutical field in India.

7 Lower Rawdon Street  
Calcutta, India  
December 2, 1948

M. L. Schroff  
The Indian Pharmacist

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" \* \* \* I appreciate your willingness to publish the material in my manuscript. (The Application of Plant Growth Regulators Including Radiation to Research in Pharmacognosy.) My sole purpose in writing it was to attempt to get other persons interested in the more experimental phases in pharmacognosy, especially along the lines of plant biochemistry and biophysics. From my contacts with younger men who are interested in biology as an experimental research field I feel certain that the exploitation of some of the ideas imparted in this manuscript fit the general thinking among pharmacognosists who wish to see this special field of pharmacy go forward. **The American Journal of Pharmaceutical Education** is read with a lot of seriousness among younger men in pharmacy as well as those who have grown up with **The Journal**. James Dille and myself have often spoken of the need for aiding the present Editor of this **Journal** in increasing the circulation of it among our younger colleagues in the field. I think the publication of papers of scientific importance from the educational point of view may aid somewhat in doing this. It appears that graduate students who may become future leaders in pharmaceutical education would be more interested in the scientific research aspect, including extensive bibliographies within such papers, so as to want to read **The Journal** religiously. Quite naturally one runs into the nature of literary reviews which are published in such journals as "**Physiological Reviews**" and "**Chemical Reviews**." Nevertheless, it seems to me that there is a place in **The American Journal of Pharmaceutical Education** for a certain number of these scientific reviews. As a graduate student

one often is so engrossed in research that the problems of education and teaching are forgotten or become of lesser importance. Therefore, a journal such as yours which tends to combine a little of both automatically enables such a researcher to see both sides of pharmaceutical education—research and teaching.

Heber W. Youngken, Jr.

University of Washington  
November 23, 1948

I am enclosing the manuscript of a paper which Dr. Goyan and I have prepared and which we believe might be of interest to readers of **The Journal** (A Lecture Demonstration Permitting Student Participation in the Use of a Surface Tension Pipette). Although you usually do not publish papers of such a nature, we have not been sure whether it is contrary to the editorial policy of **The Journal** or whether it is simply that no one submits such papers. Since we are of the belief that the latter condition prevails, we are submitting this paper in hopes that if it is published others in our schools will be prompted to pass their new teaching methods on to the rest of us through the same channel.

I for one wish that we might stimulate a little interest in creative thinking regarding that which we do day in and day out. Certainly the younger men on the various staffs should be interested in promoting an exchange of ideas and methods in the interests of improving their own teaching. The normal channel for the distribution of such ideas is through **The Journal**, and I believe that it would be extremely worthwhile if our teachers were encouraged to use this publication more freely for such a purpose.

Donald C. Brodie

University of California  
September 9, 1948

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## Marriages

Prof. Harry Leyland, associate professor of biological science, Cincinnati College of Pharmacy, and Miss Lucille Sanders of Ashland, Kentucky, on December 18, 1948.

Mr. Walter M. Markunas, Fordham University College of Pharmacy, and Miss Olga Elizabeth Klonduck on November 20, 1948, at the St. Joseph Church, Bronx, New York.



## Notes and News

**University of Arizona, School of Pharmacy:**—On December 6, the University of Arizona and the druggists of Tucson gave a testimonial dinner in the Hotel Santa Rita, honoring Mr. Newell Stewart of Phoenix upon the fact of his election to the presidency of the National Association of Boards of Pharmacy at the San Francisco meeting. Mr. Stewart has been active in the national pharmaceutical associations, and in his own state as secretary of the Arizona Board of Pharmacy and also of the State Pharmaceutical Association for many years. He has also been an outstanding citizen, mayor of the city of Phoenix and active in church and civic work. The dinner was attended by 250 persons, including the governor of the state, the mayor of Tucson, the chief administrative officers of the University, and members of the board of pharmacy who had served with Mr. Stewart through the years.—On January 14, Mr. Leslie Johnson died after having suffered from an illness through many months. Mr. Johnson was a member of the Arizona board and an outstanding druggist of the state who was instrumental in establishing the school of pharmacy in the university, and to it he gave moral and financial support far beyond what might be called the line of duty. He believed in his profession, and was willing to sacrifice generously for its improvement.

**University of Buffalo, School of Pharmacy.**—The School of Pharmacy was the first division of the University to exceed its quota in the recent community chest campaign.—The weekly two-hour seminars for seniors, pharmacists, and faculty are now in their third year. During the month of October, the discussions were confined to the probable impact of The Pharmaceutical Survey upon the pharmaceutical curriculum.—Dean A. B. Lemon has been elected president of the newly organized Buffalo Pharmacy Council which is composed of delegates elected by all the pharmaceutical organizations in and around Buffalo.

**University of Cincinnati, Cincinnati College of Pharmacy.**—Prof. Harry Legland, formerly an assistant in chemistry at the University of Cincinnati, has joined the pharmacy staff as an associate in the department of biological science, replacing Jack Baumring resigned.—Dr. Lauretta Fox and Mrs. Minna Stroller have recently published a manual devoted to laboratory exercises in general botany.—As a result of a state-wide election sponsored by the newly founded Ohio Chapter of the American Institute of Chemists, Prof. Simon Mendel-

sohn of the pharmacy staff was elected district director with jurisdiction over all membership matters in Cincinnati and Southern Ohio for a term expiring in 1950.—Mr. Alfred Siegel, the noted columnist "Cincinnati" of the **Cincinnati Post** published an article in that paper on December 2, portraying early pharmacy in Cincinnati over the past century. The article was based upon historical facts furnished by the college of pharmacy, and stressed the approaching centennial of that institution.—Microtomes, kymographs and a considerable amount of other physiological apparatus have been acquired by the biological department.—The Cincinnati public library recently sponsored an exhibit of publications by local authors in the fields of applied science. The collection on display included a volume dealing with "Embalming Fluids and Chemical Preservatives" by Prof. Mendelsohn, published in 1940. The author also exhibited several relics of antiquity from his personal collection that illustrated some of the mummification procedures of the ancients.—The seniors and their wives were guests of the Eli Lilly Company at Indianapolis on November 29-30.

**University of Colorado, College of Pharmacy.**—Dr. Harold C. Heim was the guest speaker at the November meeting of the Denver Society of Medical Technicians.—Miss Ramona Parkinson was the faculty representative who attended the regional convention of the Independent Students' Association held at the University of Denver in November.

**University of Connecticut, College of Pharmacy.**—The first convocation of the year was held in Calvary Baptist Church, which is located next to the college building. Dr. A. N. Jorgensen, president of the university, addressed the students, giving a brief history of the institution and stating its aims and objectives. He told of the plans for the college of pharmacy in the future.—At the November convocation, Rabbi Jerome Milano, of the Jewish Center in Danburg, spoke on the subject "Religion and Creeds." Plans have been made to hold convocations every two weeks throughout the year. They will be addressed by speakers on subjects of general interest to students.—Dr. Paul Jannke has recently been elected national vice-president of the Rho Chi Society.

**George Washington University, School of Pharmacy.**—Dr. Edward C. Elliott was the speaker at the November meeting of the Student Branch of the A.Ph.A.—Rachmill Schlaifsteyn, a senior pharmacy student, has been selected for "Who's Who Among Students in American Universities and Colleges." This is the second time within the past two years that a George Washington pharmacy student has been so honored.

**University of Georgia, School of Pharmacy.**—A "big brother" arrangement is being undertaken in counseling the freshmen students. Eighteen outstanding members of the senior pharmacy class are selected by the faculty as freshmen advisers. Each adviser will aid the students assigned to him to become acquainted with the ethics and general problems of pharmacy. The plan was devised by the Student Branch of the A.Ph.A.—The Alpha Kappa chapter of Rho Chi has been established at the university. Sixteen undergraduates and three faculty members, (Dr. R. C. Wilson and Profs. F. F. Millikan and W. D. Strother), are the charter members.—Dr. R. C. Wilson has been elected to serve on the Committee of Regional Council for Education.—"The Georgia Pharmacist," a student quarterly publication, is sent to all retail pharmacists in the state.—The Georgia Pharmaceutical Association entertained the students and faculty with a banquet at the Georgian Hotel on December 7.—According to recent studies of the students now enrolled, one-fourth are sons or daughters of practicing pharmacists. Approximately 95 per cent of them are Georgians. As to the distribution of graduates over the last forty years, 72 per cent remained in Georgia to practice their profession. Seven per cent went to Florida, and 3 per cent went to each of the following states: Tennessee, North Carolina, and Virginia. Two per cent went to other states in the south. Ten per cent left the southeastern region entirely. The largest number of graduates has gone into retail pharmacy. Thirteen per cent entered medicine. Seven per cent went into industrial pharmacy, and 8 per cent entered non-professional fields.—Through cooperation with the college of business administration, a course in pharmaceutical accounting is being offered for the benefit of students majoring in pharmacy. The course is especially designed to aid those students who intend to go into retail pharmacies in small towns in Georgia.

**Creighton University, College of Pharmacy.**—Dean W. A. Jarret attended a conference of the State Board of Health in Lincoln in November, the object of which was to decide if there were any possible laws governing the practice of pharmacy in the state that should be brought to the attention of the next legislature.—Dr. Victor E. Levine, who has made a study of Eskimo life and arctic conditions for many years, recently addressed the Omaha chapter of the Reserve Officers' Association on the topic "The Vast Domain of the Arctic—Its Importance in Peace and in War."—New equipment has been acquired for ten desks in the physiological laboratory and ten analytical balances, two of them being of the chain-o-matic type, for the analytical laboratories.

**University of Florida, School of Pharmacy.**—Dr. and Mrs. P. A. Foote attended the First Pan American Congress of Pharmacy which

was held in Havana, Cuba, from December 1 to 8. Dr. Foote represented the A.A.C.P. on the Committee for a Pan American Syllabus.—The Borden award of \$300 to a senior for excellence in scholarship during the first three years of his course was given to Henry Douglas Johnson. He was also awarded the Emrich prize for high scholarship during the junior year.—The following have been initiated into Rho Chi: Lawrence C. Buzzett, Lucien G. Fischesser, Mae I. Fischesser, Goette Olen Fussell, Jr., William I. Hazlett, Jr., Piri Kahlenberg, John C. King, Paul C. Koenig, Mable W. Leonhardt, Stanley Luxemburg, Wallace L. McLeod, Aaron M. Perlman, Daniel C. Smith, and Irwin W. Stephens.—Seventy-one students have petitioned the A.Ph.A. that a student branch be established at the university.—An apparatus for the production of ultra-sonic sound waves has been assembled and will be used for research purposes.—Dr. L. G. Gramling was re-elected Grand Recorder of Gamma Sigma Epsilon for another two-year term at the meeting on December 3 and 4 at the University of Georgia.

**Fordham University, College of Pharmacy.**—Dr. J. Harold Walton, Ciba Products, Inc., addressed the Alumni Association at its November meeting on the "Practical Uses of Sex Hormones."—The Student Branch of the A.Ph.A. and faculty visited the pharmaceutical laboratories of Ciba Products, Inc., at Summit, New Jersey, recently.—The New York Branch of the A.Ph.A. held its December meeting at the college. Dr. Richard Donovan, of the Squibb Institute of Medical Research addressed the group on "Further Studies on the Dihydrostreptomycins."

**Howard College, School of Pharmacy, Birmingham.**—A satisfactory grade on the pharmacy aptitude test is now a requirement for admission to the department of pharmacy. Mr. W. C. Hassell, pharmacist at the Birmingham Apothecary, has been engaged to take Mr. Thomas A. Baker's place as assistant to Dr. A. H. Olive in the course in dispensing pharmacy.—Mr. Henry Rau of Steppeville and Mr. Elton Kytte of Boaz have been engaged as assistants in the pharmacy department.—Physics, qualitative analysis, new and non official remedies, hospital pharmacy, principles of accounting, economics and pharmaceutical jurisprudence have been added to the obligatory curriculum. This leaves only 12 hours for electives in order to satisfy the requirements for graduation.—Our student branch of A.Ph.A. now numbers 110. The branch is sponsoring luncheons during the fall, winter and spring quarters in which outstanding pharmacists of city and state are the speakers.—Professor Eugene Brown is studying for the Master of Science degree in pharmacology at the medical college of the University of Alabama along with three other graduates in pharmacy. One of our graduates is doing

graduate work in pharmacology at the University of Florida. We are helping deserving students get their pharmaceutical education by way of the American Foundation for Pharmaceutical Education undergraduate fellowships. In order to get help the student must prove his scholastic worth by making the deans list, and he cannot receive help from any other source.—One million dollars has been raised to build a new Howard College campus in Edgewood in the suburbs of Birmingham. The land has been purchased and the driveways and underground conduits are being installed. Present plans call for a pharmacy-biology building.

**Idaho State College, College of Pharmacy.**—The enrollment in the 1948 summer session totaled 181. The work of the session was devoted primarily to aiding irregular students so as to orient their work into the normal semester offerings. Hereafter only a six week summer session will be offered, and there is a possibility that summer sessions will be discontinued entirely in the near future.—The staff is at work planning to place a five-year program into effect by September of 1949.—A drastic curtailment of out of state students has resulted in reducing the freshmen enrollment to 40. Selections for admission were made only from the upper percentiles of high school graduates.—Because of over crowded conditions in the main library, the rapidly expanding pharmacy library has been moved into the pharmacy building. The faculty research laboratories have been equipped with additional apparatus, including sterilizers, incubators, constant temperature baths, and pH meters. Equipment has also been provided for a manufacturing and a clinical laboratory.—Phi Delta Chi has initiated 11 new members, bringing the total membership to 45.—The Student Branch of the A.Ph.A. will soon publish their own news bulletin which will be distributed to other chapters and to the pharmacists of Idaho.

**The State University of Iowa, College of Pharmacy.**—Four \$1200 scholarships will be available to graduate students for the 1949-1950 school year. Applications should be sent to Dean R. A. Keuver at an early date.—Beverly J. Carlson, '48, was appointed assistant hospital pharmacist, beginning July 1, 1948, to fill the vacancy created by the resignation of Mildred W. Thompson, '47, who resigned to accept a position in the medical department in Kadlec Hospital, which is operated in connection with the General Electric company's atomic energy research plant at Richland, Washington.—Mr. A. J. Toller of the Toller Drug Company of Sioux City, recently established two resident school-year fee scholarships of \$150 each to be awarded to deserving students who have completed the second year in pharmacy with a minimum grade average of 2.5. The Iowa Pharmaceutical Association also recently established one school-year



scholarship of \$150 to be awarded annually to a deserving student who has completed the third year in pharmacy with a minimum grade average of 2.5. — Clifton P. Berggren, Lynn A. Laflin, Akira D. Moriyasu, Mary E. Wilke, James W. Conine, and Edward R. Rosheim were recently elected to Rho Chi. — A recent remodelling project provided an additional office and an improved storage space for special apparatus, chemicals, and office supplies. — Several articles of new equipment have been purchased for use in the undergraduate and research laboratories. Included are: a multiple electric furnace for carbon-hydrogen determinations, twenty-five prescription balances, four Volland, all-metal analytical balances, a Dumas apparatus for nitrogen determinations, a two unit Kjeldahl distillation apparatus, with electric heaters, and a Hobart A-200 mixing machine. — Prof. J. W. Jones spoke on "Improving Prescription Practice" at five of the Junior Conventions of the Iowa Pharmaceutical Association, held during the first week of October.

**University of Kansas, School of Pharmacy.**—Checks totaling \$1,000 have been deposited with the Kansas University Endowment Association in a fund to be known as the "Dean L. E. Sayre Memorial Loan Fund," in honor of the first dean of the school. Former Dean L. D. Havenhill and Walter Varnum of Lawrence have been active in the collection of these funds since the movement was begun in 1926. — Dean J. Allen Reese attended the meeting of the Midwest Conference of Pharmaceutical Associations held in Dallas, Texas, December 4 and 5. — Mr. Mars Wertzberger, district sales manager of Abbott Laboratories, gave two guest lectures before the pharmacy students on December 10th. His subject was, "A Very Important Form of Medication—Water." He demonstrated the method of giving it intravenously in both official and non-official solutions containing salts, nutrients, and vitamins. — Dr. Ralph W. Clark, Grand Ritualist, and two members of Rho Chapter, John Pistorious and Dwight Hunter, attended the Province meeting of Kappa Psi in St. Louis during the holidays.

**University of Kansas City, School of Pharmacy.** — The Kansas City College of Pharmacy, having become a part of the University of Kansas City, the alumni association of the former has been asked to participate in the activities of the alumni association of the latter. — The school has joined the American Institute of the History of Pharmacy as an institutional member. — Dr. Leslie Eisenbrandt has completed a year of post-graduate study in California, in preparation for initiating graduate work in pharmacology. — The school of pharmacy was recently elected to membership in the American Association of Colleges of Pharmacy and accredited by the American Council on Pharmaceutical Education. The school began as



the Kansas City College of Pharmacy in 1885, and was merged with the University of Kansas City in 1943. Since that time a building having 10,000 square feet has been constructed for pharmaceutical instruction. In September 1946, Dr. Leslie L. Eisenbrandt, former director of research at the Kansas City Western Dental College, joined the staff of the school as associate professor of pharmacology. Dr. Willard M. Hoehn, formerly director of research of George A. Breon & Company recently joined the staff as associate professor of pharmaceutical chemistry and director of chemical research. — The library facilities include the reference library in the building, which is supplemented by the University Library and the seven million dollar Linda Hall Library, which has assumed the responsibility for all texts and journals for the school of pharmacy. Between the three, every domestic and foreign journal of note is available to the students and staff. — The Student Branch of the American Pharmaceutical Association will place scientific books in the library in memory of Dr. Kenneth Mahony, professor of biology, who died in his home in Wisconsin, July 25, 1948. — Awards for excellence in scholarship went to Jack Allegre, Lyle Willits, Jewell Clevenger, and Charles Greene. — Dr. Hoehn recently accompanied 15 students through the Parke Davis and Upjohn manufacturing plants. — Dean Dittrich presented a paper entitled "Materials to be Added to the Pharmaceutical Curriculum" before the Sixth District meeting recently at Oklahoma City. — The Alumni Association and the Drug Association of Kansas City sponsored the Fourth Annual Seminar held in Kansas City in November. An open forum was held with a number of guest speakers in attendance.

**Long Island University, Brooklyn College of Pharmacy.** — Prof. Joseph A. Ortolan and Berl S. Alstodt were recently tendered a dinner and presented with gold watches by the college trustees in recognition of 25 years of service to the institution. — The laboratories of zoology and pharmacognosy have been equipped with 25 additional microscopes in order to take care of the increase in size of classes.

**University of Maryland, School of Pharmacy.** — Classes started for the session of 1948-49 on September 27, with a total registration of 321 students. Of this number, 76 are freshmen; 6 are veterans who were inducted into the armed forces from the school and have now returned to complete the course; 34 are graduate students, and 3 are specials. Of the total number, 179 are veterans, 15 of whom are graduate students.—New additions to the teaching staff are as follows: assistants in chemistry, Martha Lovell Adams, B.S., College of William and Mary; John G. Magiros, B.S., Maryland; and Robert I. Ellin, A.B., Johns Hopkins University. Dr. George P. Hager, Jr., succeeded Dr. Walter H. Hartung as professor of pharmaceutical

chemistry, and Dr. Glenn S. Weiland of the school of medicine is assisting in quantitative analysis until such time as a full-time instructor is appointed in the department of chemistry in the Arts and Science group. Margaret Wong Lew, B.S. in Pharmacy, Maryland, is instructing in pharmacy and is detailed to the hospital pharmacy. Assistants in pharmacy are Francis S. Balassone and Jacob S. Meyers, both graduates of Maryland. George H. Bryan, B.S. and M.S. in Pharmacy, University of Montana, is assisting in pharmacology. Shirley Shulman and Paul A. Pumpian, both graduates of Maryland, are assistants in economics and in botany and pharmacognosy, respectively.

**University of Minnesota, College of Pharmacy.** — Robert E. Kind received the Ph.D. degree at the fall quarter commencement. He is in pharmaceutical development work with Sharpe and Dohme, Glenolden, Pennsylvania. — On December 7th, Kappa Epsilon Sorority entertained students and faculty at a Christmas tea. — Hallie Bruce, chief pharmacist of University Hospitals, and Dr. Charles V. Netz served for the Minneapolis Civil Service Commission as examiners of candidates for the position of pharmacist at Minneapolis General Hospital.—On November 30, the pharmacists of Minnesota tendered a testimonial banquet to Hubert H. Humphrey, senator-elect, pharmacist, and former mayor of Minneapolis. Drs. Rogers, Netz, and Hadley were among the speakers.—C. J. Doran, Jr., C. S. Ecanow, K. R. Evarts, M. G. Matthiae, H. J. Rhodes, and H. W. Turula are new members of Phi Lambda Upsilon. — The twelfth Continuation Study Course for Pharmacists will be offered on February 13-15, 1949.

**University of Montana, School of Pharmacy.** — The largest enrollment (194) in the history of the school was reached during the current term. — Gordon H. Bryan and Glenn H. Hamor have resigned from the staff, the former to continue graduate work in pharmacology at the University of Maryland, and the latter to do graduate work in pharmaceutical chemistry and serve as a teaching assistant in pharmacy at the University of Minnesota. The vacancies their resignations created are being filled by Mrs. Dorothy A. Anderson and Francis C. Hammerness, both graduates of Montana and both having had practical experience in retail pharmacy before entering the teaching fields. — Robert Devillechabrolle of Eu, Province of Seine, France, who is a graduate of the University of Paris, Faculté de Pharmacie, and who before coming to the United States did research work in hematology in the Faculté de Médecine, and spent several months working in drug serology at the Pasteur Institute of Lille, has registered for graduate work in pharmacology.—Charles McNichol, 1948, has received a check for \$500 for his prize winning

paper, "Scientific Stock Control," from the National Association of Retail Druggists' national essay contest. A check for a like amount was also awarded the school of pharmacy.—Dean Emeritus C. E. F. Mollett has been presented with a plaque by the national organization of Kappa Psi in commemoration of his services as national vice regent for the fraternity through a long period of years.

**University of Nebraska. College of Pharmacy.**—The University Research Council has awarded \$300 as a grant-in-aid to Leonard Nelson for research on "Potassium Toxicity and the Protective Action of the Amino Acids on Cardiac Measurements."—The Rho Chi chapters of Creighton University and the University of Nebraska held a joint meeting in Lincoln on December 20.—Recent equipment acquisitions include a Parr-Sulfur apparatus, a Micro-Kjeldahl equipment, and Beckman Spectrophotometer chamber adapters.—The building planning committee of the university issued a report which proposes a new building for the college of pharmacy to be built in 1952-53.—Fourteen students were initiated into Kappa Psi fraternity on November 3.

**University of North Carolina. School of Pharmacy.**—An architect has been assigned by the University to prepare plans for a new pharmacy building for which an appropriation of \$966,000 will be requested from the State Assembly.—The Phi Delta Chi fraternity purchased a house for its permanent quarters.—The Kappa Psi fraternity was successful in renting a house.—The Rho Chi First Year Award was won by William Cash.—The Xi chapter of Rho Chi has initiated nine members this year.—The Student Branch of the North Carolina Pharmaceutical Association was addressed during the fall quarter by Dr. W. H. Hartung on "Changing Trends in Pharmacy"; by Dr. H. R. Totten on "Native Trees as the Source of Drugs;" and by Mr. I. T. Raemer, chief pharmacist of the Duke Hospital Pharmacy, on "Hospital Pharmacy."—The Pharmacy Senate recently sponsored the technicolor film, "Intocostrin," through the courtesy of E. R. Squibb and Sons.—Dr. H. O. Thompson is again teaching pharmacology at the Nursing School of Watts Hospital in Durham.—Dr. Hartung recently addressed the North Carolina Branch of the American Chemical Society on "Epinephrine."—Dean M. L. Jacobs was appointed to the Commission on Human Medicine and Health Services of the Regional Council on Education, and recently attended a three-day meeting at Atlanta, Georgia.

**The Ohio State University. College of Pharmacy.**—Dr. John W. Nelson recently spoke before the Summit County Pharmaceutical Association in Akron on the subject "Sex Hormones."—At the December commencement, Ismail Amin Abdel-Latif of Cairo, Egypt,

was granted the Ph.D. degree. The subject of his dissertation was "New Spectrophotometric and Fluorometric Methods of Assay for Alexandrian Senna Leaves, Applicable to all the Emodin Group of Drugs."—Prof. Clarence M. Brown was the A.Ph.A. representative at the inauguration of the President of Heidelberg College, Tiffin, Ohio.—On December 3, the annual Christmas party sponsored by the Pharmacy Council was held. The gifts exchanged at this party are donated to Columbus underprivileged children.—On December 15 and 16, Dr. E. C. Elliott, Director of The Pharmaceutical Survey, and P. H. Costello, Secretary of N.A.B.P., were on the campus in connection with inspection for accreditation by the A.C.P.E.—Rho Chi initiated seven new members at the close of the fall quarter.—Dr. Amos B. Colby recently visited the Purdue University and University of Illinois schools of pharmacy to study the manufacturing pharmacy facilities.

**Oregon State College, School of Pharmacy.**—The school celebrated its golden anniversary on November 12 and 13. The ceremonies included a joint meeting of the North Pacific and Student Branches of the A.Ph.A., and an open session of the Oregon State Pharmaceutical Association.—The Student Branch is conducting regular monthly meetings, presenting outstanding speakers in the pharmaceutical field and pertinent films.—The local chapter of Kappa Psi held a reunion of alumni on October 30 and 31.—Rho Chi is sponsoring a series of monthly seminars for seniors.—Mrs. Wallace Lambert (Bethella Sherman '47) is employed as pharmacist in the student health service.—Adolph Ziefle, dean emeritus and a member of the staff for 34 years was formally retired on July 1.—Prof. Leo A. Sciuchetti has been appointed Benton County Red Cross first aid chairman.

**Purdue University, School of Pharmacy.**—A complete set of Beilstein's Handbook of Organic Chemistry has been acquired by the library.—Following the annual dinner on December 4, awards were made as follows: The Borden award consisting of a certificate, the inscription of a name on a plaque, and cash in the amount of \$300 went to Laverne DeMong, editor of the Purdue Pharmacist and a distinguished student throughout the first three years of his course; the Merck award went to Julia Mae Reyburn; the distinguished student award given by the faculty went to Richard K. Verhoestra; the Kappa Psi Key, awarded by the national chapter to those students who have maintained the highest distinguished rating in their class, was presented to Dale W. Blackburn and Richard K. Verhoestra.—On December 5 and 6, the school of pharmacy was re-inspected by P. H. Costello and Frank Moudry for purposes of accreditation under the new standards established by the American Council on

Pharmaceutical Education. Dr. Edward C. Elliot accompanied the representatives of the Council. This was the first one inspected under the new standards.

**Rutgers University, College of Pharmacy.**—There are 100 new students in the freshman class.—Eleanor Stagg, a graduate of the New York College for women, has been appointed an instructor in the biological sciences.—Ralph T. Fisher of the New Jersey State Department of Health is giving a course in public health to the senior class.—Dr. John M. Cross recently attended a four week course in nuclear studies at the Oak Ridge Institute of Nuclear Studies.—Martin Blake, a graduate of Fordham, and Andrew Bartilucci, a graduate of St. John's College of Pharmacy, have been admitted to the Graduate School.

**St. Louis College of Pharmacy and Allied Sciences.**—Announcement is made of an undergraduate course of five years. Upon completion of the fourth year of the course, the degree B. S. (Pharmacy) is given, and upon the completion of the fifth year, the degree B. S. (Industrial Pharmacy) is granted. Graduate courses in Industrial Pharmacy as a major, and Quality Control as a major, are also being offered leading to the M. S. degree.

**Temple University, School of Pharmacy.**—The Board of Directors of the Foundation for Therapeutic Research visited the school recently and inspected the new building and its equipment. Dean H. Evert Kendig was elected a member of the board.—Dean Kendig attended a recent meeting of the National Drug Trade Conference.—A patent has been issued to Dr. Milhail B. Plungian, assignor to the University, on the "Solubilization of Rutin with Methyl Glucamine."—Dr. Herbert M. Cobe recently addressed the Cumberland Valley Dental Association and the Clinic Club of Philadelphia on the subject "Dental Caries." Dr. Cobe is engaged in research with members of the dental faculty on the use of sodium fluoride in the prevention of dental caries.

**The University of Tennessee, School of Pharmacy.**—Alpha Nu chapter of Rho Chi was installed on December 20, by Dr. Karl Goldner, a member of the council. Charter members were Dean R. L. Crowe, Drs. Goldner and Musick, and Mr. Bowles of the pharmacy faculty, and fifteen members of the graduating class.—Bachelor of Science degrees in pharmacy were conferred on 59 students on December 20. The commencement address was delivered by Dr. Robert P. Fischelis. His subject was "The World Awaits You."—Mr. Grover C. Bowles has resigned to take a position as Chief Pharmacist, Strong Memorial Hospital, University of Rochester,



Rochester, New York. W. B. Swafford, a recent graduate of the school of pharmacy, has been appointed instructor in pharmacy to replace Mr. Bowles.—Dr. Albert Musick spent the Christmas vacation in California.

**University of Texas, College of Pharmacy.**—For the first time in its history, the pharmacy school participated in the annual Texas Personnel Conference program, which was held on the university campus. Three of the lectures and discussions were of special interest to pharmacists.—Dean Burlage attended eight and Dr. C. O. Wilson, two of the district's meetings of the state association.—Dr. Wilburn H. Ferguson of Quito, Ecuador, recently visited the university campus in the interest of a research program devoted to a study of drugs native to the South American jungles. While here he spoke before the students concerning drugs and medicinal plants used by the head hunters of South America. He exhibited specimens of a number of these drugs, as well as a number of shrunken skulls from the Amazonian area.—Prof. Ernest Stuhr, because of an allergy developed in the Austin region, has resigned and returned to his home in Portland, Oregon.—A survey of the freshman students revealed that 65 entered the university with high school preparation only; 111 transferred from junior colleges; 62 from another college in the University of Texas; 47 transferred from other colleges in the state; and 14 transferred from colleges outside of Texas. Also, 19 students in the class have an A. B. degree, 14 a B. S. degree, and one an A. M. degree. Several of them are registered nurses, one is a registered mortician, and one a registered veterinarian.—Members of the pharmacy staff who are also members of the graduate faculty are revising and perfecting the graduate pharmacy program which will lead to the M. S. degree with majors in pharmacy, pharmacognosy, and pharmaceutical chemistry.

**University of Utah, College of Pharmacy.**—The American Council on Pharmaceutical Education has given the school provisional accreditation for its first two years of instruction which are now being given.—The Student Branch of the A.Ph.A. is planning the first issue of a publication to be known as the "Pharmic-Ute" which will appear during the winter quarter.—C. E. Athas, the Smith-Faus Drug Company, John B. Heinz, and the Western Pharmacal Company, all of Salt Lake City, and McKesson and Robbins, Inc., of Ogden, have purchased new unit prescription desks for the dispensing laboratory. An appropriately engraved plate has been affixed to each desk.—On December 22, the male pharmacy chorus presented a Christmas recital to a group of invited guests in the Utah Union Building.

**Medical College of Virginia, School of Pharmacy.**—A combined office and laboratory has been recently equipped.—Drs. Smith, Kauf-



man, and Neuroth, and the president and executive secretary of the Virginia Pharmaceutical Association have been attending various meetings of retail druggists throughout the state.—Dr. Herbert McKennis, a recent graduate, is also a member of the team.

**State College of Washington, School of Pharmacy.**—Mrs. P. H. Dirstine is serving as president of the Faculty Wives' Club this year.—Lambda Kappa Sigma has recently initiated five, and Rho Chi, four new members, including Mr. and Mrs. Su Ming Wang, graduate students from Shanghai, China.—Recently, additional space has been allocated which will provide for new dispensing, pharmacology, manufacturing pharmacy, and pharmacognosy laboratories.

**Wayne University, College of Pharmacy.**—Dr. Simon Benson has been recently appointed assistant professor of physiology and pharmacology, and faculty adviser to the student publication, *The Wayne Pharmic*.

**Western Reserve University, School of Pharmacy.**—An American Foundation for Pharmaceutical Education fellowship of \$1200 has been awarded Charlotte D. Curtiss, an alumna, who will pursue work leading to the Ph.D. degree in pharmacology. William A. Feiler, a senior and president of Rho Chi, has been awarded an undergraduate scholarship of \$100.—Kappa Psi fraternity, inactive since the beginning of the late war, is being reactivated with thirty-eight new initiates.—A Fisher senior titrimer, a power tablet machine, an incubator, a hot-air sterilizer, six new typewriters, a fifty gallon steam jacketed kettle, and fifty-five new volumes for the library constitute the newly acquired equipment.

**University of Wisconsin, School of Pharmacy.**—A laboratory of physical pharmacy has just been completed to improve facilities for teaching physico-chemical principles. New equipment includes a spectrophotometer, interfacial tensiometer, viscosimeter and conductivity bridge. This area of instruction and research in the pharmacy department is under the direction of Dr. Takeru Higuchi, who was formerly engaged in the government's synthetic rubber research program at the University of Akron.—A new micro-combustion furnace and micro-Kjeldahl apparatus has been added to equipment in the pharmaceutical chemistry department.—In the industrial pharmacy laboratory, a rotary tablet machine has been obtained to increase facilities for student instruction and production capacity for tablets supplied to dispensaries of Wisconsin state institutions.—The school now has a long-term research project under way in medicinal powder technology, using spray-dryer equipment provided last year by the University's Research Committee.—Dr. Joseph V. Swin-

tosky became a full-time instructor in pharmacognosy this year, replacing Dr. Amos B. Colby, who accepted a post at Ohio State. Dr. Swintosky is also the new faculty adviser of the University Pharmaceutical Society, a joint organization representing the student branches of the Wisconsin Pharmaceutical Association and the American Pharmaceutical Association.—A Pharmaceutical Military Science Unit of the R. O. T. C., one of four in the country, was established this year under a directive from the Army's Medical Service Corps. Excellent progress has been made under Major Ralph D. Arnold, who is in charge of the project and is also taking graduate work. His assistant is Sgt. Ollan L. Melville.—Dr. George Urdang has been appointed an honorary consultant to the Army Medical Library by the Surgeon General. In December he attended the First Pan-American Congress of Pharmacy as a guest of the Congress, serving as president of the Section on History of Pharmacy in America.—Publications from the American Institute of the History of Pharmacy at the school led the British **Chemist and Druggist** to state (October 9, 1948 issue) that the Institute's position has been confirmed "as the world's center of historical research in pharmacy," adding: "Competent students in all countries will increasingly draw on the resources of this institution, now seven years of age."—Glenn Sonnedeker, formerly editor and director of public relations for the A.Ph.A., is now at Wisconsin for graduate work in the history of pharmacy and science and is serving as assistant to the director of the Institute.—Miss Shirley Foster, formerly instructor at the University of Mississippi, is pursuing graduate work and teaching in the dispensing laboratory.—Graduate students from overseas include Miss Jesusa Concha of the Philippines, Miss Anna Havinga of Holland, Mohit Chandra Gupta of India and Miss Betty Y. Wu and Y. D. Mao of China.—A former student of the late Dean Edward Kremers, Dean Patrocino Valenzuela of the University of Philippines school of pharmacy, reports that the postwar reestablishment of his institution is now being completed.

**University of Wyoming, School of Pharmacy.**—Arrangements have been made with the college of commerce and industry to give three courses in business specifically designed to meet the needs of pharmacists. They will be given for the first time in September of this year.—President C. D. Humphrey attended a conference on December 10, in Denver of representatives from Wyoming, Utah, New Mexico, and Colorado at which the possibility of a regional school of medicine, dentistry, and veterinary medicine was discussed.—A number of additions on the subjects of pharmacy and pharmacognosy have recently been made to the library.

## Miscellaneous Items of Interest

### A Memorial

CHARLES WILLIS JOHNSON

(1873-1949)

Charles Willis Johnson, 75, Dean Emeritus of the College of Pharmacy, University of Washington, died January 9 at his home after a long illness. The impersonal facts concerning who Dean Johnson was, his educational background, professional accomplishments, memberships, and public honors, can be found in such documentaries as **Who's Who** and **American Men of Science**. Their portrayals serve only to indicate that here was a person of distinction who vigorously served Pharmacy throughout a long and active life and who had his share in the growth and strengthening of the profession. They will prove only that the history of modern pharmacy cannot be fully told without reference to his contributions.

Such cold expositions do not tell of the man himself. They do not project his character or personality. They enumerate the results of his living but they do not tell how he lived. Only his friends and intimates can tell you that.

Born a farmer's son in Concord, Indiana, his schooling was all mid-western. Public schools at St. Joe and Universities at Purdue and Michigan led to a Ph. D. and an instructorship in chemistry at Iowa State University. After a year there, he came to Washington as assistant professor. The following year he became Dean of the College of Pharmacy.

Seattle then was scarcely more than a village. The University had but recently been moved to the forested hillside overlooking Lake Washington and Lake Union. This 573 acre campus was, for all practical purposes, out in the country. It was penetrated by a few paths and corduroy roads. The College of Pharmacy was in the basement of old Denny Hall. Only a man of courage and vision could have seen much future there. Because Dean Johnson was such a man, he stayed. He saw the University grow into one of the ten largest universities in the nation. He built the College into one of the strong professional units of our Association.

To do this, he had to battle tradition, legislatures, factions, and work against the handicap of small budgets. He had to make the breaks come his way. He kept Washington's prestige alive throughout this struggle by his active participation in the national pharmaceutical circles. There still was time to be concerned with the problems of non-professional fellowship. He helped organize and so became a charter member of local Masonic bodies and the Men's Faculty Club. His family grew to include a boy and two girls.

Such encompassing interests and activity developed to an extraordinary degree the many facets of Dr. Johnson's life. His capacity for sympathy and understanding was great. His friendships were strong and steady. His mental curiosity and intellectual drive were terrific. His fighting heart kept him going long after a weaker man would have quit. His modesty increased his dignity. One never learned from him that he had been president of the American Association of Colleges of Pharmacy and the American Pharmaceutical Association and had been head of other important national and local organizations and had been responsible for the success of many a colleague and former student. The reward he most wanted was not loud public acclaim, but that the things he strove so mightily for were right and that those whom he counselled succeeded and became men.

Yes, Charles Willis Johnson is dead, but only in the mortal sense. His passing was purely a physical phenomenon common to all men. To those of us who knew him, he is with us still. The shadow of death could do no more than remove his body. Spiritually, there has been no change.

L. Wait Rising

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### **THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY**

#### **Program of the Fiftieth Annual Meeting**

President, J. Lester Hayman; Vice-President, J. Allen Reese; President-elect, B. V. Christensen; Secretary-Treasurer, Louis C. Zopf; Chairman of the Executive Committee, Joseph B. Burt.

Saturday, April 23

10:00 A. M. Meeting of the Executive Committee

1:30 P. M. Meeting of the Executive Committee

Sunday, April 24

9:30 A. M. Meeting of the Executive Committee

**FIRST SESSION**

Sunday, April 24, 2:00 P. M.

1. Roll call
2. Appointment of Committee on Resolutions
3. Appointment of Nominating Committee
4. Appointment of Auditing Committee
5. Report of the President, J. Lester Hayman
6. Report of the Secretary-Treasurer, Louis C. Zopf
7. Report of the Executive Committee, Joseph B. Burt
8. Recommendations from the Executive Committee on the Implementations of the Pharmaceutical Survey, Joseph B. Burt
9. Report of the Editor of the American Journal of Pharmaceutical Education, R. A. Lyman
10. Report of the Credentials Committee
11. Reports (abstracts) of Standing Committees
  - (1) Committee on Relations of Boards and Colleges, Hugo H. Schaefer
  - (2) Committee on Libraries, Charles O. Lee
  - (3) Committee on Activities for Alumni, Linwood F. Tice
  - (4) Committee on Problems and Plans, R. A. Lyman
  - (5) Committee on Status of Pharmacists in the Government Service, D. B. R. Johnson
  - (6) Committee on Educational and Membership Standards, Arthur E. James
  - (7) Committee on Pharmaceutical Research, Arthur E. Schwarting
  - (8) Committee on Graduate Study, John E. Christian
  - (9) Committee on Curriculum, George L. Webster

**CONFERENCE OF TEACHERS IN GRADUATE INSTRUCTION**

Sunday, April 24, 7:30 P. M.

Chairman, R. B. Smith, Jr.; Vice-Chairman, Lloyd Harris; Secretary, Haakon Bang; Representative on the Committee of Conference of Teachers, G. P. Hager.

1. Panel Discussion on Research Problems and Courses Best Suited for the Graduate Education of Personnel for:
  - Pharmacy Instruction, L. Wait Rising
  - Manufacturing Pharmacy, Noel E. Foss
  - Hospital Pharmacy, W. Arthur PurdumDiscussion from the floor.
2. Accreditation of Graduate Instruction, E. L. Brecht
3. Proposed By-Laws for the Teachers' Conferences, John Christian

Monday, April 25, 9:00 A. M.

Teachers' Conferences, see pages following Third Session for programs

**SECOND SESSION**

Monday, April 25, 2:00 P. M.

1. The First Pan-American Congress of Pharmacy, Commander W. Paul Briggs
2. Recent Adventures in Accreditation  
Dr. Edward C. Elliott
3. Report of the American Council on Pharmaceutical Education,  
P. H. Costello
4. Address of the incoming President, B. V. Christensen
5. A Method for the Selection of Students Applying for Admission  
to Colleges of Pharmacy, E. R. Serles
6. To Be or Not To Be,  
Robert P. Fischelis
7. Our Observations on the Initiation and Conduct of the Pharmacy  
R. O. T. C. Unit at the University of Minnesota, Charles H. Rogers

Monday, April 25, 6:00 P. M.

Joint Dinner—National Association of Boards of Pharmacy and  
the American Association of Colleges of Pharmacy.

Address: The Profession of Pharmacy as Viewed by an Educator  
Dr. J. Hillis Miller, President, University of Florida

**JOINT MEETING OF TEACHERS'  
CONFERENCES**

Tuesday, April 26, 9:00 A. M.

John E. Christian, Chairman, Committee on Teachers' Conferences  
Proposed By-Laws for the Teachers' Conferences

**PANEL DISCUSSION**

"The Pharmaceutical Curriculum"

Moderator, President J. Lester Hayman

General Education, Lloyd E. Blauch

Pharmacy, Louis W. Busse

Administrative Pharmacy, Stephen Wilson

Chemistry and Mathematics, George L. Webster

Biological Sciences, Troy C. Daniels

Open Forum

**THIRD SESSION**

Tuesday, April 26, 2:00 P. M.

Reports of Special Representatives:

1. Delegates to the American Council on Education, B. V. Christensen



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2. Representative to the American Council on Pharmaceutical Education, B. V. Christensen
3. Representative to the National Drug Trade Conference, W. Paul Briggs
4. Delegate to the House of Delegates of the American Pharmaceutical Association, Henry S. Johnson
5. Representative to the National Wholesale Druggist Association, Earl R. Serles
6. Directors of the American Foundation for Pharmaceutical Education, H. Evert Kendig

Recommendations from Teachers' Conferences

Report of Historian, George Urdang

Report of Special Committees

- A. Committee on Predictive and Achievement Tests, Ralph F. Voight
- B. Committee on Professional Relations, P. A. Foote
- C. Committee on Personnel Problems, J. Allen Reese
- D. Committee on Emergency Problems, H. Evert Kendig
- E. Committee on Teachers' Conferences, John E. Christian
- F. Committee on World Congress for Pharmaceutical Education, George Urdang
- G. Committee on Audio Visual Education, Donald C. Brodie
- H. Committee on Constitution and By-Laws, B. V. Christensen

Report of Committee on Resolutions

Report of Auditing Committee

Miscellaneous Business

Election of Officers

New Business

Executive Session

Adjournment

CONFERENCE OF TEACHERS OF  
PHARMACY

Chairman, Leslie M. Ohmart; Vice-Chairman, Joseph B. Sprowls;  
Secretary W. Lee Huyck; Representative on the Committee of Conference of Teachers, A. I. White

Monday, April 25, 9:00 A. M.

1. Call to Order
2. Chairman's Address, Leslie M. Ohmart
3. Secretary's Report, C. Lee Huyck
4. Appointment of Committees
5. Open Forum
  - A Can the Pharmacy Courses be Taught Adequately in Two Years, F. J. O'Brien
  - B Is Pharmacy No Longer to be a Major in the Pharmaceutical Curriculum, Kenneth Waters

- C The Effect of the Increased Prescribing of Proprietarys on the Teaching of Pharmacy Subjects, Joseph B. Sprowls
- D The Dispensing Course—Its Content and Method, Elmer Plein
- 6. Discussion of the Proposed By-Laws of the Committee on Teachers' Conferences
- 7. Election of Representatives to the Committee on Teachers' Conferences for Two Years
- 8. Election of Officers
- 9. Adjournment

CONFERENCE OF TEACHERS OF  
BIOLOGICAL SCIENCES

Chairman, A. E. Schwarting; Vice-Chairman, C. H. Waldron; Secretary, E. P. Claus; Representative on the Committee of Conference of Teachers, A. F. Voight

Monday, April 25, 9:00 A. M.

- 1. Call to Order
- 2. Report of the Chairman, A. E. Schwarting
- 3. Secretary's Report, E. P. Claus
- 4. Appointment of Committees
- 5. PHARMACOGNOSY:
  - The Biochemical Approach to Instruction in Pharmacognosy  
Dr. E. E. Roscoe, Idaho State College
  - The Organization of the General Course in Pharmacognosy  
According to a Physiological Pattern  
Drs. H. W. Youngken, Jr., and A. C. Neva, University  
of Washington
- 6. PHARMACOLOGY:
  - What One May Learn from Experimentation on a Single  
Animal  
Dr. Harald Holck, University of Nebraska
  - The Use of Moving Picture Films in Connection with the  
Teaching of Pharmacology  
Dr. R. P. Walton, Medical College of South Carolina
- 7. VISUAL EDUCATION:
  - Medical Literature of Pharmaceutical Industry in Visual  
Education  
Dean C. W. Ballard, Columbia University

8. Election of Officers
9. Adjournment

CONFERENCE OF TEACHERS OF  
CHEMISTRY

Chairman, Arthur Osol; Vice-Chairman, Abraham Taub; Secretary, R. S. Kelley; Representative on the Committee of Conference of Teachers, H. G. Hewitt

Monday, April 25, 9:00 A. M.

1. Call to Order
2. Report of the Chairman, Arthur Osol
3. Appointment of Committees
4. Round Table Discussion, Arthur Osol, Moderator
  - "The Colloidal State"
  - General Principles
  - Content of Course
  - Lecture
  - Laboratory
  - Pharmaceutical Applications
5. The By-Laws for the Organization of the Conferences
6. Unfinished Business
7. New Business
8. Report of the Committees
9. Installation of New Officers
10. Adjournment

CONFERENCE OF TEACHERS OF  
PHARMACEUTICAL ECONOMICS

Chairman, C. W. Bliven; Vice-Chairman, C. I. Cooper, Secretary, Arthur P. Wyss; Representative on the Committee of Conference of Teachers, Stephen Wilson

Monday, April 25, 9:00 A. M.

1. Call to Order
2. Chairman's Address, C. W. Bliven
3. Secretary's Report, Arthur P. Wyss
4. Appointment of Committees
5. A Variation of The Reward System as Applied to Term Papers  
Ralph Bienfang
6. Experiments With The Problem Type of Examination in Business Subjects for Pharmacy Students  
Paul C. Olsen

7. An Experiment With Pharmaceutical Administration at Howard University  
Chauncey I. Cooper
8. Use of Prescription Pricing Schedules in the Dispensing Pharmacy Course  
Arthur P. Wyss
9. Election of Officers
10. Adjournment

#### AMERICAN INSTITUTE OF THE HISTORY OF PHARMACY

1. The **annual meeting** of the Institute will, in compliance with Article VI of the "Articles of Organization," be held at **Madison, Wisconsin**, on the first Thursday of April, i. e., on

**April 7, 1949.**

2. At the A.Ph.A. meeting to be held at Jacksonville, Florida, on April 24-30 there will be again **joint sessions of the A.Ph.A. Section on Historical Pharmacy and the American Institute of the History of Pharmacy.**

The session, presided over by officers of the A.I.H.P. will be devoted to a series of short papers on **Pioneers in American Pharmacy.**

Arthur H. Uhl  
President

#### THE TWENTY-SIXTH ANNUAL PLANT SCIENCE SEMINAR

The Seminar will be held at the University of Wisconsin at Madison during the week beginning August 21, 1949. There will be no meeting of the Seminar at Jacksonville, Florida, in connection with the convention of the National Pharmaceutical Association as has been the practice in the past. The officers of the Seminar felt that the attendance would be small if held at that time of year, because of the impossibility for Seminar members to leave their school duties for two weeks at that time of the year. They, therefore, accepted Dr. A. H. Uhl's invitation to meet at Madison in August. Dr. Joseph V. Swintosky is acting as local secretary for the meeting and is formulating a most profitable program. Members will receive future bulletins giving details of the program.

Edward P. Claus, Secretary

## Minutes of the Meetings of the Executive Committee of the American Association of Colleges of Pharmacy

Chicago, Illinois  
December 10-11, 1948

### First Session

1. The meeting was called to order by Chairman J. B. Burt at 10 a. m. Members present: President J. L. Hayman, Deans G. E. Crossen, H. C. Newton, R. B. Smith, Assistant Dean N. F. Foss, Director A. H. Uhl, Editor R. A. Lyman, and Secretary L. C. Zopf.
2. Dr. Uhl presented the report of the **Committee on Pharmacy Seminar**, suggesting a tentative program for Committee comment and discussion. Teaching personnel was suggested with stress being placed on teaching methods or the 'how' of teaching pharmacy.

Dean Newton moved that the tentative program for the **Pharmacy Seminar**—subject to revision—be accepted and approved for presentation by Chairman Burt to the Foundation at its meeting in January.

Seconded by Dean Foss. Carried.

3. Editor Lyman reported on the progress of the Committee for Compiling an **Annotated Index** for, "The American Journal of Pharmaceutical Education." It was the unanimous opinion that such an index was desirable and that the responsibility for continuation of the investigation be assumed by the Editor.
4. The following recommendation referred from the Association was discussed: Proposal that the **Committee on Achievement and Predictive Testing** be authorized to develop a plan for administration of predictive and achievement tests as a basis for membership in the American Association of Colleges of Pharmacy. Dean Smith moved that the **A.A.C.P. Committee on Achievement and Predictive Testing** be authorized to design such a test to be used as a basis for admission to our schools and colleges.

Seconded by Dean Foss. Carried.

5. Secretary Zopf reported the favorable vote for membership in this Association for:  
A—University of Kansas City, School of Pharmacy  
Kansas City, Missouri  
B—Southern College of Pharmacy, Inc.  
Atlanta, Georgia

6. Chairman Burt read a communication from Secretary Costello of the **American Council on Pharmaceutical Education**, which directed attention to a revision of **Section III, "Teaching Load and Size of Classes"** in **Standards to be Used as the Basis of Accreditation of Colleges of Pharmacy**.

A—"As a general rule, teaching schedules shall not exceed sixteen semester hours or twenty-four clock hours per week, per teacher, and the number of students per teacher in a class or section, exclusive of lectures, shall not exceed thirty."

The Secretary was instructed to notify all member schools and colleges with regard to the **revised standard**.

7. The method for classification of accredited schools was briefly discussed.

#### Luncheon Recess

Dean B. V. Christensen joined the Committee as it reconvened at 1:20 p. m.

8. Secretary Zopf was requested to read the minutes of the San Francisco meeting to review the action taken with regard to referred resolutions.
9. President Hayman reported the **elimination of six special committees** and the appointment of a new Committee on Constitution and By-Laws. This action was in keeping with the resolution approved at the San Francisco meeting suggesting re-examination of all committees and special appointments.
10. The following action was taken with regard to **Pharmacy Reserve Officers Training Corps Units**:

A—Assistant Dean Foss moved that the Secretary indicate the Association's interest in the establishment of Pharmacy R.O.T.C. Units to the **Joint-Committee on the Status of Pharmacist in the Armed Service** for the purpose of presenting the problem to the Armed Services, and

B—That the Secretary communicate with the deans and directors of all member schools, now having R.O.T.C. units or eligible therefor; encouraging them to request the establishment of a Pharmacy Unit. Local contacts as a means of initiating activity not to be overlooked.

Seconded by Dr. Uhl. Carried.

11. President Hayman gave a report of the meeting of The Pharmaceutical Survey Committee.
12. After considerable discussion of the **six-year course** as approved by this Association in meeting at San Francisco, Dean Newton moved that the degree of Doctor of Pharmacy may be granted on the completion of a six-year program of education and training, the program to include two years of general education and basic



science training and four years of professional education and training in an accredited college of pharmacy.

Seconded by President Hayman. Carried.

13. All recommendations from the **Findings and Recommendations of The Pharmaceutical Survey 1948**, directed to the American Association of Colleges of Pharmacy were read and discussed.

Recommendation 2 of Section IV, "Student Selection, Guidance and Testing."

Dean Crossen moved that this recommendation be referred to the Committee on Achievement and Predictive Testing.

Seconded by Dr. Uhl. Carried.

Recommendation 2 of Section IX, "The Prescription Study," was referred to the Committee on Professional Relations.

It was with unanimous approval that Chairman Burt agreed to appoint **Sub-committees for the purpose of studying the recommendations of The Survey**. Membership of these Sub-committees not to be limited to the Executive Committee, but the Chairman of each Sub-committee is to be appointed from the Executive Committee membership.

14. Means of financing a **full-time secretary** for the Association were discussed.

Assistant Dean Foss moved that the Chairman appoint a committee to develop a well defined business-like proposal and program which would outline the need to the Foundation and the universities for a full-time secretary.

Seconded by Dr. Uhl. Carried.

15. Dr. Uhl moved that the Association subscribe to **membership in the Medical Library Association**.

Seconded by Dean Crossen. Carried.

16. President Hayman read the report of the **Special Committee on Time of A.A.C.P. Meetings**. The Committee recommended meetings concurrently with the A. Ph. A. and N. A. B. P. for 1949 and if the attendance at the 1949 meeting is found to be small due to the time of holding such meeting—consideration be given to holding the annual meeting of the A. A. C. P. at a time and place separate from that of the meetings of the A. Ph. A. .

17. The **agenda for the Jacksonville meeting** was discussed. The first meeting of the Executive Committee is scheduled for 10:00 a. m. Saturday, April 23; the first General Session is scheduled for 2:00 p. m. Sunday, April 24.

18. Editor Lyman was authorized to print 200 extra copies of the **list of member schools and colleges** for use in the Secretary's office.

19. Dr. Fischelis and Secretary Costello were invited to bring mat-

ters of mutual interest before the Executive Committee at this time.

**Dr. Fischelis, Secretary** of the A. Ph. A., discussed the Selective Service Act and the results of his questionnaire on deferment, which had previously been sent to the deans of all member colleges. He also submitted a questionnaire on Hospital Pharmacy which he indicated would give the Association information which they need to answer questionnaires from pharmacists and prospective students interested in this field of specialization.

Just shortly before Dr. Fischelis came into the meeting, Secretary Zopf suggested that the A. A. C. P. should have a **brochure on Pharmacy** which he could mail to students requesting such information. He was instructed to investigate such ideas. It was, therefore, suggested to Dr. Fischelis that perhaps his questionnaire and that of this Association might be combined and submitted as one questionnaire coming from the A. A. C. P., since both Associations were interested in practically the same type of information.

Mr. Costello, Secretary of the **American Council on Pharmaceutical Education**, spoke briefly regarding certain recommendations referred to the Council and also suggested that the attention of all colleges of pharmacy be directed to the **changes in the accreditation policy and procedure of the Council**. He approved the renewal of the joint N. A. B. P.—A. A. C. P. banquet for the Jacksonville meeting.

Adjourned 10:00 p. m.

### Second Session

20. The meeting was called to order by Chairman J. B. Burt. Members present: President J. L. Hayman, Deans B. V. Christensen, G. E. Crossen, H. C. Newton, R. B. Smith, Assistant Dean N. F. Foss, Director A. H. Uhl, Editor R. A. Lyman, and Secretary L. C. Zopf.
21. The **minutes of the meeting** of December 10 were read, amended and approved.  
Dr. Uhl moved that the **minutes of the December 10 and 11 meeting** of the Executive Committee **be distributed to all member colleges**.  
Seconded by Dean Smith. Carried.
22. Dr. Christensen gave an oral report on the October 10 and 11 meeting of the American Council on Pharmaceutical Education. He mentioned the reorganization of the Council indicating that **Dr. George D. Beal** was elected as **President**, and **Mr. P. H. Costello** was named as **Secretary-Treasurer**. The Council was par-

ticularly interested in coordination of their efforts with those of the Survey Director, Dr. Elliott.

The Council voted to employ an individual whose title would be '**Director of Educational Relations**' and who would be one of the members of the **Visitation or Inspection Committee**.

The Council is particularly interested in carrying on coordination and implementation of The Pharmacy Survey with particular reference to the functioning of the Council and its Visitation Committee.

Dr. Christensen also suggested that the state boards would be invited to observe the **inspection and visitation** of schools and colleges in their respective states; but that the state board members would have no voice in the inspection or final judgment of the institutions. It was indicated that **one member of each board** would be invited to represent the boards on the Visitation Committee. It was the hope of the Council that **inspections would begin immediately** and continue at the rate of two inspections a week until all schools had been visited.

Dr. Christensen reviewed some of the points and standards for accreditation; emphasizing that all accredited colleges were to receive the **new brochure from the Council** within a very few weeks.

Assistant Dean Foss moved that the report be received and approved.

Seconded by Dr. Uhl. Carried.

24. Dr. Uhl moved that Dean Christensen be appointed to serve as our **representative on the American Council of Pharmaceutical Education** to complete the unexpired term of Dr. Andrew DuMez.

Seconded by Dean Newton. Carried.

25. Dr. Fischelis called indicating that he had further information which he wished to discuss with the Executive Committee. He was granted the privilege of the floor.

Dr. Fischelis directed the Committee's attention to the **Selective Service Manual** and indicated the effect which it might have on students enrolled in the colleges of pharmacy.

Assistant Dean Foss moved that the Secretary communicate with the Chairman of the **Committee on Emergency Problems** instructing him to contact Dr. R. P. Fischelis, Chairman of the **Committee on National Security and Defense**, in connection with the deferment of pharmacy students and to develop a plan for presentation to the Executive Committee as promptly as possible, but not later than April 1, 1949.

Seconded by President Hayman. Carried.

26. Chairman Burt reported that an additional **sum of \$2,000** had been forwarded to the Secretary-Treasurer by the **American Foundation for Pharmaceutical Education** for financial assist-

ance in publishing the October and January issues of the **American Journal of Pharmaceutical Education**.

Chairman Burt stated that the members of the **Foundation's Subcommittee to study the needs of the Journal**, Mr. Lawson, Mr. Bellis, and Dean Kendig, were very much interested in the success of the **Journal** and were giving further consideration to its needs.

27. President Hayman moved that a **list of faculty subscribers** to the **American Journal of Pharmaceutical Education** be compiled, and that a letter encouraging individual faculty subscriptions come from the Executive Committee.

Seconded by Dean Smith. Carried.

28. Chairman Burt reported that Dr. Ernest Little had been unable to represent this Association as **delegate to the First Pan-American Congress of Pharmacy** and that he had requested Commander W. Paul Briggs to represent this Association.

Dr. Uhl moved that the registration fee of \$10 for our delegate to the First Pan-American Congress of Pharmacy be allowed.

Seconded by Assistant Dean Foss. Carried.

29. Editor Lyman read a communication from Professor Brodie, Chairman of the **Committee on Audio-Visual Education Aids** which resulted in the following action:

Dr. Uhl moved that the expenses be allowed for the publication of reprints of the Audio-Visual Education Committee's "Film Catalog" to be made available to the member colleges.

Seconded by Dean Smith. Carried.

30. Dr. Lyman told the Executive Committee that the Claflin Company of Lincoln, Nebr., publishers of the **Journal** have discontinued business, and that the Jacob North Company is printing the January issue. The question of securing **bids for publication of future issues of the Journal** was discussed and Editor Lyman was directed to investigate.

31. Dr. Christensen directed the Executive Committee's attention to a communication from Dr. Elliott which enclosed a letter from 'Science Service' suggesting that after reading the first report of The Pharmaceutical Survey, they believed that Section IV of the report indicated the possibility of a project for a "Science Talent Search."

Dean Crossen moved that the Secretary be instructed to refer this communication to the **Committee on Predictive and Achievement Tests** for further study and consultation with Director Elliott.

Seconded by Assistant Dean Foss. Carried.

32. The Executive Committee discussed certain details of the April meeting leaving suggestions with the President and Secretary for implementation.

Dr. Uhl moved that the **abstracts of Committee reports be limited to five minutes**, unless in the judgment of the President more time is required; to allow as much time for discussion as possible, and that the **Chairman of each Committee furnish 150 mimeographed copies of the complete report** for distribution at the annual meeting.

Seconded by Dean Newton. Carried.

33. The Executive Committee urgently requests all deans and faculty members to indicate immediately any reports or papers which they contemplate presenting at the April meeting in Jacksonville.

Adjourned at 12:15 p. m.

Louis C. Zopf  
Secretary-Treasurer

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## Items of Human Interest

Dr. and Mrs. Jack E. Orr, University of Utah, with their daughter Judy, spent the Christmas holidays with their parents in Delphic, Indiana.

Dr. and Mrs. Willis Brewer, University of Utah, and their daughter Susan, visited Dr. and Mrs. Woodrow R. Byrum at the University of Arizona at Tucson during the holidays.

Dean L. J. Klotz, Cincinnati College of Pharmacy, was a recent visitor in a consulting capacity to the School of Pharmacy of the Southwestern State College at Weatherford, Oklahoma.

Dr. Albert Musick, University of Tennessee, spent the Christmas holidays in California.

Dean and Mrs. Charles H. Rogers of the University of Minnesota College of Pharmacy spent the Christmas holidays with their son, Robert Rogers, M. D., who is surgeon with the Fargo, North Dakota, Clinic.

Dean and Mrs. Dittrich, University of Kansas City, spent the Christmas holidays with Dean Dittrich's parents in Baltimore.

Dean George Crossen, Oregon State College, and Dean C. I. Cooper of Howard University were recent visitors on the University of Minnesota campus.

Rosemary Von Bank, '48, University of Minnesota, spent the summer with a hosteling group traveling through the Netherlands, France, Italy, and Switzerland. Thelma Muesing, a senior, spent the summer with a SPAN group in Western Germany, and Betty Ann Hadley will spend the summer of 1949 with such a group in Italy.

## The Twenty-fifth Annual Plant Science Seminar\*

The silver anniversary of the Plant Science Seminar was held at the University of Washington College of Pharmacy and at Mount Rainier National Park from August 2 to 5, 1948. Although Seattle is about 900 miles from San Francisco, the convention city of the American Association of Colleges of Pharmacy and the American Pharmaceutical Association, sixty-eight members and guests attended and all agreed that the 25th meeting was highly successful.

Following registration, which was held in Bagley Hall on the University of Washington campus, the first session was called to order by Chairman Ralph F. Voigt. A cordial welcome was extended by Dean Forest J. Goodrich of the College of Pharmacy. In his chairman's address Dr. Voigt indicated not only the need for research in the field of pharmacognosy but also the excellent opportunities for pharmacognosists in general. A moment of silence was observed for Dr. Elmer H. Wirth who had passed away since the last Seminar. Dr. Wirth's efforts as secretary of the Seminar for 14 years, his accomplishments in the field of pharmacognosy, and his constant good humor had made him a beloved member of the organization.

Dr. Arthur H. Uhl, President of the American Association of Colleges of Pharmacy, encouraged the Seminar to consider methods of presenting subject matter as well as the actual subject matter itself. His remarks were well received and brought favorable discussion. Committees appointed were as follows: Nominating Committee—Dr. Franklin J. Bacon, chairman, Mr. John E. Seybert, and Dr. Robertson Pratt; Resolutions Committee—Dr. J. Allen Reese, chairman, Dr. Arthur H. Uhl, and Mr. Dan Ungar. Dr. H. A. Langenhan reported for the Local Committee, the other members being Dean Forest J. Goodrich and Dr. Heber W. Youngken, Jr., who acted as local secretary. Guests were introduced following which Dr. E. L. Newcomb, one of the original founders of the Plant Science Seminar, congratulated the Seminar on its achievements in the past twenty-five years. After the meeting adjourned, the group visited the laboratory facilities of the College of Pharmacy until twelve-thirty when a delightful luncheon was served to the members and their guests on the east lawn of Bagley Hall. This luncheon was sponsored by the I. P. Callison Company of Seattle. Two members of this firm, Mr. Henry Callison, the president, and Mr. Paul Tornow, the chief chemist, spoke informally on the Cascara, Digitalis, and Peppermint Industries of the Pacific northwest. At the conclusion of these informative talks the group photograph was taken.

\*For the complete report of the Plant Science Seminar see the 1948 Convention Proceedings of the American Pharmaceutical Association.



An afternoon sight-seeing bus trip for the ladies of the Seminar was sponsored by Mr. H. D. Pilchard of Wyeth, Incorporated. The more scientific-minded members attended the afternoon session which was held in Bagley Hall. The theme was "The Application of Certain Principles of Plant Physiology to the General Course in Pharmacognosy." Dr. Margaret Dyar of the University of Washington botany department spoke on "Plant Physiology as Taught to Undergraduate University Students." Dr. Dyar indicated the need for organic chemistry as a background course for a proper understanding of plant physiology. Dr. George B. Rigg, emeritus professor of botany of the University of Washington, spoke on "Material in Plant Physiology that can be made Applicable to Problems in Pharmacognosy." Dr. Rigg humorously recalled some of his experiences in teaching pharmaceutical botany to the pharmacy students and then pointed out the relationships existing between the physiological processes in the plant and the development of the active constituents.

Following these excellent presentations Dr. Heber W. Youngken, Jr., assistant professor of pharmacognosy at the University of Washington, presented a well-prepared paper entitled "The Application of Plant Growth Regulators Including Radiations to Research in Pharmacognosy." Dr. Youngken covered this subject fully and explained some of the experiments which were in process at the greenhouse of the pharmacognosy department. To appreciate these research problems the remaining time was spent in a tour of the medicinal plant gardens and the plant laboratory. Here the Seminararians observed the effects of growth stimulants on drug plants and took note of the results which indicated whether or not the percentage of active constituents had been increased.

That evening at the home of Dean and Mrs. Goodrich in Laurelhurst the Seminar members and guests assembled for a tasty buffet dinner. The surroundings were pleasant and cool, and the friendly spirit so characteristic of the Seminar was in evidence as the group ate in the attractive dining room, the inviting terrace, and the colorful game room of the Goodrich residence. The latter part of the evening was spent at the Faculty Men's Club on the University campus where natural color motion pictures of the Pacific northwest were exhibited. Bridge and billiards completed a highly enjoyable social affair.

Tuesday morning the session consisted of the presentation of papers and a collaborative laboratory exercise. Dr. Robertson Pratt of the University of California presented his work on "The Cytochemical Mechanisms of Action of Certain Antibiotics." Dr. Pratt discussed the penicillin-resistant organisms as well as those which are inactivated by this mold product. His consideration included the

various methods of assay of antibiotics. Dr. Heber W. Youngken, Sr., of the Massachusetts College of Pharmacy then read a short paper entitled "Has Valerian Been Underestimated?" in which he stressed the need for reinvestigation of this plant drug.

A laboratory exercise on Hayfever Pollens occupied the remainder of the morning. Dr. Edward P. Claus of the University of Pittsburgh distributed instruction sheets containing information about pollen grains which are a causative factor in pollinosis. Methods of examination, identification, and measurement of pollen grains and mold spores were presented. Exposed atmospheric slides were studied to determine the variety of aerobiological matter.

The Seminarists then assembled at the Hotel Edmond Meany for lunch at which they were the guests of the Curry Laboratories of Seattle. Mr. Harold Curry, president of the laboratories, is greatly interested in the activities of the Seminar and arranged the luncheon for the Seminar members and guests. Dr. Raymond B. Allen, President of the University of Washington, was the principal speaker. He emphasized the importance of team work in medical research and cited some of the new products which have been developed through cooperation of the workers in allied fields. Following the luncheon the Seminarists took their cars and began the ninety mile drive to Mount Rainier National Park. Although Mount Rainier could be seen from Seattle at the start, the closer the group approached the peak the more difficult it was to see through the blanket of fog. Paradise Lodge, at an elevation of 5,500 feet, was the final destination and, by the time all had arrived, the fog was so dense that visibility was zero.

After quarters had been assigned and dinner was over, the Seminar gathered in groups to discuss the harrowing details of their fog-laden drive until time for the Annual Watermelon Party. This affair was originated by the late Dr. A. John Schwarz and is a traditional feature of the program. Dr. E. T. Bodenberg, the park naturalist, first presented a lecture on "The National Park Service" illustrated by his natural color slides which depicted scenes at Mount Rainier and other places of interest. There followed a moment of silence dedicated to the memory of Dr. Schwarz, Dr. O. P. M. Canis, Dr. E. H. Wirth, Mrs. E. L. Newcomb, Miss Sue Ann Youngken, and others who had shared in previous Seminar activities. Then in the custom of this part of the program, huge slices of watermelon were served as well as coffee, ice cream and cake. Musical entertainment and group singing climaxed a very pleasant evening.

The dense fog that had closed about Mount Rainier had not lifted by the next morning and the temperature was in the thirties. How-

ever, a number of hardier Seminararians donned parkas and boots and, under the guidance of Dr. Bodenberg, climbed to the timberline. Between the snow banks was a pattern of flowers: red pentstemons, white anemones and glacier lilies, and blue lupines. In addition, many stands of the green hellebore (*Veratrum viride*) attracted attention. Following a hearty lunch provided through the generosity of S. B. Penick and Company of New York City, everyone was ready to start on the afternoon trip. The sun had dispelled most of the fog and the higher temperature was conducive to botanizing at the base of the snow-covered peaks.

At 6:30 the annual Seminar Dinner was held at Paradise Inn, a short walk from the Lodge. Under the witty direction of Dr. Langenhahn who acted as master of ceremonies the program developed into a most entertaining affair. Dr. Uhl told several amusing stories and Doctor James C. Munch of Temple University in his own inimitable manner convulsed the group with his "Convention to end all Conventions."

It was decided to hold the final business session that evening at nine o'clock. The Nominating Committee presented its report and the following were elected: chairman, J. Allen Reese, University of Kansas; first vice-chairman, Dr. Heber W. Youngken, Jr., University of Washington; second vice-chairman, Dr. J. Hampton Hoch, Medical college of South Carolina; secretary, Dr. Edward P. Claus, University of Pittsburgh; members of the Executive Committee, Dr. Ralph F. Voigt, University of Illinois; the president and the secretary. The Resolutions Committee in its report, expressed the appreciation of the Seminar to all who had taken part in its program and, in addition, presented the following resolution: **Be it resolved**, that the Plant Science Seminar, realizing the importance of the development of good teachers in our colleges of pharmacy, express its desire to the American Association of Colleges of Pharmacy to cooperate in a program for the improvement of our teachers in the field of pharmacognosy. The Report on Pharmacognosy of The Pharmaceutical Survey was discussed until the small hours of the morning at which time the 25th Annual Seminar was adjourned.

The spirit of informality and good fellowship for which the Seminar has become noted was displayed throughout the entire meeting. New friendships were made and older ones were renewed. The thought was expressed by all that to combine a vacation, see old friends, and accomplish a stimulating exchange of ideas there is nothing better than attendance at a Plant Science Seminar.

The 16 A. A. C. P. colleges represented were the universities of California, Illinois, Purdue, Drake, Iowa, Kansas, Massachusetts Col-

lege of Pharmacy, Minnesota, Montana, Ohio State, Western Reserve, Pittsburgh, Washington, Wisconsin, and the State College of Washington and Temple University. In addition, representatives of the University of Wyoming, Boston School of Pharmacy, American University at Beirut, University of Cairo at Cairo, University of Chattanooga, chemistry department, and Eli Lilly and Company were in attendance.

Edward P. Claus, Secretary

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In December, The Pharmaceutical Survey released the following information relative to the total number of undergraduate students registering in accredited colleges in the fall of 1946, 1947 and 1948. The totals were 15,075,—18,105,—and 19,728 respectively. For the same years, the total number of graduate students was 253, 302, and 352, making a grand total in 1948 of 20,080. 1,827 of the undergraduates and 49 of the graduate students were women. The grand total of both undergraduate and graduate G.I. students in the fall of 1947 and 1948 was 12,333 and 12,209, respectively, of which 67 and 61 were women. Four of the nine non-accredited schools reported a fall enrollment of 875.

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The work of the Joint Committee of the American Pharmaceutical Association and the American Social Hygiene Association in the effort to eliminate disease deserves the earnest support of all pharmacists and all those engaged in pharmaceutical industry. In a bulletin issued early in January, Dr. Robert P. Fischelis calls attention to the part the year-round activities of the various social hygiene agencies have had in bringing closer the goal of eradicating the venereal diseases. He also stresses the fact that one of the most important parts of any program of disease prevention is an **extensive** and **sound** program of public information. It is in this phase of the program that the pharmacist can be of the greatest assistance. It is possible for secretaries of state pharmaceutical associations, colleges, all kinds of local pharmaceutical organizations, and individual pharmacists to obtain material for distribution and for the construction of programs by addressing the American Social Hygiene Association at 1790 Broadway, New York 19. While the control of disease is an every day job, the work is highlighted annually by the use of Social Hygiene Day programs which this year are set for February 2.

## The Pharmaceutical Survey, A Resume\*

A long-range program designed to increase pharmacy's public-service contribution to the health of the nation was disclosed in Washington today (November 22, 1948) as the American Council on Education published the first section of the findings and recommendations of The Pharmaceutical Survey.

Purpose of The Survey was to insure that pharmacy continues to occupy its proper place among the health professions in a post-war era marked by expanding opportunities for greater service to the public.

Based on a study covering all phases of the practice of pharmacy—with particular emphasis on professional education, The Survey's recommendations are directed toward increasing the pharmacist's prestige and standing in the community and among his fellow professionals in the broad health field.

Although inaugurated and financed by various segments of the profession of pharmacy and the drug industry, supervision of The Survey was entrusted to the American Council on Education as a means of obtaining an impartial, objective, "outsider's" viewpoint. As Director of The Survey, the Council chose Dr. Edward C. Elliott, President Emeritus of Purdue University, who served as Chief of the Division of Professional and Technical Training for the War Manpower Commission during the last war.

Upon the urgent recommendation of the American Association of Colleges of Pharmacy, the necessary funds for The Survey and the work of implementing the recommendations, amounting to \$162,000, were made available by the American Foundation for Pharmaceutical Education.

Assisted by a staff of specialists, Dr. Elliott made a two and one-half year searching analysis of the facts of pharmacy. The material

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\*This statement prepared and released by The Survey on November 22, 1948, gives a brief story of the objectives, the method of procedure, the results of the study, and a prophecy of the distinguished Director of The Survey who has set a new horizon for pharmacy. While this story is familiar to most of us, we feel that the publication of this brief resume will be scanned and appreciated by many who may not have followed closely the progress of The Survey since its conception. Following this resume, in order to make the record complete and give at least a mild recognition to those who have given their services so unselfishly, we print a complete list of the personnel of the Committee of The Pharmaceutical Survey. —Editor

collected and tabulated covers every phase of the practice of pharmacy from the salaries of college professors through to the handling of prescriptions at the retail drug store level. A large portion of this supporting data will be published later in separate volumes. Additional recommendations also may be made.

In preparing the findings and recommendations contained in the 50-page volume now being released by the Council, Dr. Elliott was advised by a 17-man Advisory Committee which included a spokesman for the public as well as representatives of the broad field of education and leaders in various phases of the profession of pharmacy. He also maintained close contact with various officials of leading professional, educational, and other organizations in the field of pharmacy. (A listing of these Survey Committee members is attached.)

Survey Director Elliott traveled 40,000 miles in the two and one-half years during which he and his staff gathered material for the study. He visited 30 colleges of pharmacy, addressed 50 meetings of pharmacy groups, and went behind the prescription counters of almost 300 drug stores scattered through 20 states. During the current year he will supervise the implementation of the various phases of the Council's long-range program for improving the profession. In fact, footnotes attached to various sections of The Survey findings indicate that certain steps already have been taken to implement parts of the recommendations.

The Number One objective of The Survey recommendations is to provide the nation with an adequate supply of properly trained professional pharmacists to man the nation's 55,000 retail drug stores and the increasing number of hospital pharmacies. The Survey also took into account the increasing demand for professional pharmacists in the armed forces, various other branches of the government, and in the drug manufacturing and wholesaling fields.

However, The Survey findings also warn against producing an oversupply of pharmacists—a condition which might deprive some trained men and women of the opportunity for reaping adequate economic rewards and personal satisfactions from the practice of their profession. The Survey emphasizes that **quality** is more important than **quantity**.

Specific recommendations include: Raising the standards of admission to the nation's 70 colleges of pharmacy; more careful testing and screening of students during the early college training; and efforts on the part of state and local pharmaceutical organiza-



tions to encourage young high school men and women of ability and personality to seek a career in pharmacy.

Another recommendation proposed a general overhauling of the present four-year college pharmacy course, with greater emphasis on the basic pharmaceutical sciences and increased instruction on the economic aspects of the practice of pharmacy. In addition, The Survey urged adequately equipped and staffed pharmacy colleges to establish six-year college programs leading to the degree of Doctor of Pharmacy.

Other Survey recommendations include: Creation of a Commission on Pharmaceutical Manpower to insure adequate records for the balancing of supply against demand for trained pharmacists in time of peace as well as national emergency; more effective organization and operation of state boards of pharmacy and the modernization of their examination systems for legal licensure; organization of a National Convention for Pharmaceutical Legislation to formulate uniform legal controls in the interest of public health; more financial support for colleges from commercial and industrial interests; the continued upbuilding of the teaching staffs of the colleges and schools; plans for the in-service training of practicing pharmacists; the appointment of a full-time executive officer for the American Council on Pharmaceutical Education, the agency which inspects and accredits colleges of pharmacy. A system of classifying colleges into A, B and C institutions is proposed.

One of the most difficult undertakings of The Survey was the detailed analysis of more than 13,000 prescriptions assembled from 220 pharmacies, located in 186 cities, towns and villages of 39 states. The results, which furnish a comprehensive review of modern prescription practice, provide important data for the profession of medicine as well as pharmacy. These results reflect the far-reaching changes which scientific research and the mass production of medicinals have brought about in providing improved medication which doctors can prescribe for their patients.

In the introduction to the findings, Dr. Elliott took cognizance of the problems which result from the fact that the vast majority of the nation's pharmacists who practice in the retail drug store must be successful business men as well as capable professionals. Despite good-natured ribbing of the retail drug store as it exists today, Dr. Elliott points out that it has developed to supply the neighborhood need for a great variety of convenience items, and as a social center.

In addition, Dr. Elliott indicates, the drug store must sell related items in order to support convenient neighborhood pharmaceuti-

cal service for those who need a handy source of medicines and prescriptions to meet health emergencies. The Survey reports:

"From the beginning the American pharmacist had engaged in the merchandising of a variety of related commodities and neighborhood-convenience items. Only in rare instances was the commerce in medicinals sufficient for the successful maintenance of a strictly professional establishment.

"In consequence the 'drug store' evolved under the conditions of a free enterprise trade economy. Within variable limits the range of its commercial undertakings was greatly extended. In the language of the day it became a 'department store' which also served as a sort of social center for the community."

To which Dr. Elliott added his personal comment: "During The Survey I have come to a keen realization of the critically important place in American life occupied by the pharmacist, especially the pharmacist of the well-known corner drug store. A new profession of pharmacy is coming to be. The character and standards of this new profession are of interest to the whole of our people.

"The records show that this year close to four hundred million prescriptions will be filled in the more than fifty thousand retail drug stores in the country. The American people need to realize that every time a prescription is taken to one of these establishments, not only health but oft-times life, is at stake. The American health standards more and more demand competent professional pharmacists.

"Pharmacy is very much alive. Its leaders are energetically proceeding to place pharmacy on a higher professional level. The pharmacist promises to be more important than ever before in providing health service for the American people."

#### **THE PHARMACEUTICAL SURVEY**

Edward C. Elliott, **Director**

President Emeritus, Purdue University

**Formerly:** Professor, University of Wisconsin

Chancellor, University of Montana

#### **THE COMMITTEE**

##### **ON THE PHARMACEUTICAL SURVEY**

Appointed by the American Council on Education

W. W. CHARTERS, **Chairman**, Director, Research Service, Stephens College; **formerly:** Dean, School of Education, University of Mis-

souri; Dean, School of Education, University of Illinois; Director, Bureau of Educational Research, Ohio State University; Director, Commonwealth Study of Pharmacy

ANDREW DuMEZ,\* **Vice Chairman**, Dean, School of Pharmacy, University of Maryland; Secretary-Treasurer of the American Council on Pharmaceutical Education; Past-President, American Pharmaceutical Association; Past-President, American Association of Colleges of Pharmacy

\*Deceased, September 27, 1948.

GEORGE D. BEAL, Assistant Director, Mellon Institute of Industrial Research; Chairman of the Council, American Pharmaceutical Association; Vice Chairman, Committee of Revision, **United States Pharmacopoeia**; Vice Chairman, American Council on Pharmaceutical Education; Past-President, American Pharmaceutical Association

W. PAUL BRIGGS, Commander (MSC) USN, Head, Pharmacy Section, Professional Division, Bureau of Medicine and Surgery, U. S. Navy; Treasurer, Ex Officio Member, Board of Trustees, **United States Pharmacopoeia**; **formerly**: Chief, Pharmacy Division, Veterans Administration; Dean, School of Pharmacy, George Washington University

B. V. CHRISTENSEN, Dean, College of Pharmacy, Ohio State University; Chairman, Executive Committee, American Association of Colleges of Pharmacy; Member, Committee of Revision, **United States Pharmacopoeia**; Past-President, American Pharmaceutical Association; **formerly**: Director, School of Pharmacy, University of Florida

DONALD A. CLARKE, Apothecary-in-chief to the Society of the New York Hospital; Research Fellow and Member of the Teaching staff, Department of Pharmacology, Cornell University Medical College; Lecturer in Pharmacology, New York Hospital—Cornell University School of Nursing

GEORGE V. DOERR, First Vice President, McKesson & Robbins, Inc.; President, American Foundation for Pharmaceutical Education

CARSON P. FRAILEY, Executive Vice President, American Drug Manufacturers Association; President, National Drug Trade Conference; Chairman, Drugs Resources Advisory Committee, Medical Department of the United States Army and Bureau of Medicine and Surgery of the United States Navy

H. EVERT KENDIG, Dean, School of Pharmacy, Temple University; Past-President, American Association of Colleges of Pharmacy

FRANK W. MOUDRY, Secretary, Minnesota State Board of Pharmacy; Chairman, Executive Committee of the National Association of Retail Druggists; President, National Association of Boards of Pharmacy; President, Apothecary Shop, Inc., St. Paul, Minnesota

EDWARD S. ROGERS, Chairman of the Board, Sterling Drug, Inc.; Member of Board of Grants, American Foundation for Pharmaceutical Education

JOHN A. STEVENSON, President, Penn Mutual Life Insurance Company; Trustee, University of Pennsylvania, University of Chicago, Temple University, George Peabody College for Teachers; Director, Bell Telephone Company; Director, Pullman Company.

ROBERT L. SWAIN, Editor, **Drug Topics**; Editor, **Drug Trade News**; Chairman, Board of Trustees, **United States Pharmacopoeia**; Member, American Council on Pharmaceutical Education; Past-President, American Pharmaceutical Association; Past-President, National Association of Boards of Pharmacy

FRANK O. TAYLOR, Chief Chemist (Retired), Parke, Davis & Company; Chairman, Combined Pharmaceutical Control Committee of the American Drug Manufacturers Association and American Pharmaceutical Manufacturers' Association; Executive Committee, Committee of Revision, **United States Pharmacopoeia**

CHARLES R. WALGREEN, Jr., President and Director, Walgreen Company; Director and Past-President of the National Association of Chain Drug Stores; Member, University of Illinois College of Pharmacy Advisory Board

GEORGE F. ZOOK, President, American Council on Education, **ex officio**

A. J. BRUMBAUGH, Vice President, American Council on Education, **ex officio**

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The newly elected officers of the American Pharmaceutical Association are Glenn L. Jenkins of Purdue, president; Harold C. Kinner, Washington, D. C., first vice president; Leib L. Riggs, Portland, Oregon, second vice president. Members elect of the Council for a term of three years are George D. Beal, Pittsburgh, and John B. Heinz, Enid, Oklahoma. Installation of these officers will take place at the annual meeting in Jacksonville, Florida, on April 24, 1949.

## Recommendations of the Pharmaceutical Survey of Especial Interest To or Affecting the American Association of Colleges of Pharmacy\*

### I

#### *The Supply of and the Demand for Trained Pharmacists— Professional Manpower Records*

1. IT IS RECOMMENDED that there be set up, under the auspices of the American Pharmaceutical Association, an agency to be known as the "Commission on Professional Manpower for Pharmacy." This commission would be composed of one representative of each of the organizations holding membership in the National Drug Trade Conference and such other representatives as the commission may desire.

4. IT IS RECOMMENDED, pending the development of more reliable and dependable basic data by the commission, that a replacement factor of 3.1 percent be employed for the projection of manpower needs.

5. PENDING THE organization and operation of the Commission on Professional Manpower for Pharmacy, the Committee on The Pharmaceutical Survey:

A. RECOMMENDS to the Executive Committee of the American Association of Colleges of Pharmacy that the member-institutions of the Association be advised, (1) as to the apparent needs for graduates immediately after 1951 in the region normally served by them, and (2) that students should be chosen more carefully from the applicants for admission in order to assure that the public welfare responsibility of the profession will be met.

B. RECOMMENDS to the American Council on Pharmaceutical Education that it notify accredited institutions that in the plans for the re-examination and re-accrediting of institutions—which plans are now in process—particular importance will be attached to the adopted policies of the institutions for maintaining the size of the

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\*While these recommendations appear in the "Findings and Recommendations of The Pharmaceutical Survey" which have appeared in booklet form, they are printed here for the convenience of quick reference for those who might not take the time to ferret them out of the "Findings."

several classes of students at a level consistent with the physical and teaching facilities.

7. IT IS RECOMMENDED that each college or school of pharmacy maintain more effective relations with its alumni for the purpose of securing and utilizing that information relative to the educational and economic factors affecting the present and future personnel for pharmacy.

## II

### *The American Council on Pharmaceutical Education*

1. IT IS RECOMMENDED that the American Council on Pharmaceutical Education, representing as it does the active cooperation of the American Association of Colleges of Pharmacy, the National Association of Boards of Pharmacy, and the American Pharmaceutical Association, be recognized as the national agency for the accrediting and betterment of colleges and schools of pharmacy; and,

2. IT IS RECOMMENDED that the constructive influence of the Council be exerted, not only by the systematic examination, rating, and accrediting of institutions, but also by serving as a coordinating center for the consideration of plans and efforts for the progressive improvement of pharmaceutical education.

3. IT IS RECOMMENDED that the American Council on Pharmaceutical Education be provided with a properly staffed and equipped central office, directed by an executive officer, to be designated as the "Commissioner for Pharmaceutical Education."

4. IT IS RECOMMENDED that national agencies related to pharmacy be urged to supply funds to provide, for a minimum period of four years, adequate, dependable financial support of the essential and important work of the Council. The minimum amount of such support is estimated to be \$20,000 for 1948-49, \$30,000 for 1949-50, and \$40,000 for 1950-51 and for each year thereafter. These amounts are to be in addition to the funds now being received by the Council from other sources.

6. IT IS RECOMMENDED that the Council formulate and publish to the colleges a clearcut statement indicative of the twofold objectives of the Council: first, that of operating as a recognized agency for the safeguarding of minimum educational standards and practices for the profession; and, second, that of advising, stimulating, and assisting the American Association of Colleges of Pharmacy and



the individual institutions in raising the minimum standards and improving the practices of the profession.

7. IT IS RECOMMENDED that the Council reexamine its existing statement of minimum requirements for accreditation. For example, the provisions of the present standards dealing with finance, organization, and administrative policy are not fully applicable to the great majority of the colleges and schools operated as units of tax-supported universities.

8. IT IS RECOMMENDED that the following proposals, relating to the reinspection and reaccrediting of institutions, previously submitted by the Director of The Survey, receive the favorable consideration of the Council:

A. THAT THE COUNCIL secure from the president of each of the institutions in which a college, school or department of pharmacy is maintained as a unit, an official statement as to: (1) The status of pharmacy within the institutional organization, and, in particular, (2) Whether pharmacy is considered to stand on the same level as the other major units of the institution, (3) Whether the staff of the school—scientifically, educationally, and salary-wise—is comparable to the staffs of other divisions of the institution, (4) Plans of the institution for the development and improvement of professional training in pharmacy.

B. THAT THE DEAN of each college or school of pharmacy: (1) Submit a report dealing primarily with the changes that have taken place since the time of the most recent inspection and accrediting—changes indicative of betterment as to finances, faculty, library, scientific facilities, and quality of student body. This report would be expected to give special attention to the items of criticism indicated in the report of the council inspecting committee; (2) Indicate which, if any, of the published standards for accreditation are not now fully met by the college, with appropriate explanations; (3) Transmit two copies of the catalog for the current year; (4) Furnish copy of the budget or financial statement for the current year; (5) Furnish copies of the weekly class and/or laboratory schedule of each instructor, with the number of students in each class or laboratory section; (6) Forward a list of scientific research and other publications by each member of the staff during the past five years; (7) Indicate the service of each member of the staff to professional organizations; (8) Describe plans in effect for the qualitative selection and guidance of students; also describe measures for adjusting size of student body to professional needs and opportunities; (9) Describe plans in effect for the placement of and follow-up work

with graduates; (10) Indicate the record of graduates, annual number passing and annual number failing, in state board examination; (11) Present an analysis and an interpretation of the curriculum in effect so as to reveal a definite unified educational plan, and the extent to which the pharmaceutical technical training is reinforced by the elements of a broad general education.

C. THE ADOPTION OF a system of classification of accredited institutions, such as:

CLASS A: Those colleges having no important deficiencies.

CLASS B: Those colleges having deficiencies that may be corrected promptly by administrative action.

CLASS C: Those colleges having deficiencies requiring considerable time and effort to correct. A college in this class will be given a period of three years to correct the deficiencies or be dropped from the accredited list.

9. IT IS RECOMMENDED that the Council include in its accrediting specifications standards for:

A. THE UTILIZATION of recognized intelligence and aptitude tests as factors for the admission of students, and

B. THE MAINTENANCE of facilities under adequate direction and supervision for the continuous guidance and counseling of all students.

### III

#### *The Teaching Staffs*

1. IT IS RECOMMENDED that each of the accredited institutions carefully re-examine its staff problem both as to present and future needs. A statement of these needs, defined as completely as may be possible, should be transmitted each year to some designated center such as the American Council on Pharmaceutical Education. These statements, assembled from all institutions, may then serve as a measure and a guide, especially for those institutions and individuals engaged in graduate study. In other words, pharmacy must develop a systematic program designed to establish a continuous balance of the supply of and the demand for new teaching personnel. This is a manpower issue of the first order.

2. IT IS RECOMMENDED, in view of the prime importance of the deanship of a college or school of pharmacy as the central source for professional and personal leadership, that responsible administrative authority consult fully and widely those familiar with pharmaceutical personnel when making appointments to this position.

3. IT IS RECOMMENDED, as a principal activity of the implementation of The Pharmaceutical Survey, that the problem of the teaching staff with emphasis upon the items of adequate compensation, the reduction of teaching loads, and the provision of opportunity and means for individual research work be presented to the boards of control and other higher education authorities.

4. IT IS RECOMMENDED that the institutions give special attention to undergraduate students of personality, of scientific ability and interest in the profession, and encourage such students to proceed with the advanced study required to qualify for teaching service.

5. IT IS RECOMMENDED that the proposal for the conduct of summer seminars for teachers of pharmaceutical subjects, already presented by the Director of The Survey to the American Association of Colleges of Pharmacy and to the American Foundation for Pharmaceutical Education, receive the prompt attention of these organizations, and be put into operation beginning with the summer of 1949. The primary purpose of these seminars is that of providing needed opportunity for the members of the teaching staffs, and for graduate students to come into fruitful contact and to keep pace with progressive content and methods of pharmaceutical teaching.

6. IT IS RECOMMENDED that the American Council on Pharmaceutical Education, in full cooperation with the American Association of Colleges of Pharmacy, encourage certain of the accredited colleges and schools of pharmacy, properly staffed and equipped, and advantageously located, to serve as centers for the preparation of teachers of pharmacy.

7. IT IS RECOMMENDED that the American Foundation for Pharmaceutical Education include in its program, for the encouragement of graduate study, provision for not less than twenty teaching fellowships, for the purpose of enabling individuals of ability and professional promise to become especially fitted for teaching service.

#### IV

##### *Student Selection, Guidance, and Testing*

1. IT IS RECOMMENDED that each of the accredited institutions:

A. UTILIZE recognized intelligence and aptitude tests as constituent factors for the selection and admission of students.

B. MAINTAIN facilities, under adequate direction and supervision, for the continuous guidance and counseling of all students,

such facilities to include a complete personnel record of each student.

2. IT IS RECOMMENDED that steps be taken by the American Association of Colleges of Pharmacy for the development and validation of specialized aptitude and achievement tests for students of pharmacy, such tests to be administered by the individual colleges at the time of admission, during the period of education and training, and prior to graduation. It is advised, in this connection, that the institutions provide for the cost and that the Association seek the counsel and cooperation of the recently formed Educational Testing Service.

3. IT IS RECOMMENDED that the American Foundation for Pharmaceutical Education include within its program of operation provision for the preparation, distribution, and revision of an appropriate handbook containing essential current facts relating to the profession of pharmacy, for the use of vocational counselors and prospective students in pharmacy.

4. IT IS RECOMMENDED that each state and local pharmaceutical association create a standing Committee on Superior Students for Pharmacy. This committee, in cooperation with the colleges and schools of pharmacy of the state, would seek to identify secondary school students and college students of marked ability; to deepen the interest of such students in the study of pharmacy; and, when necessary to enlarge their opportunity to proceed with education and training for the profession. Such an undertaking is based upon the assumption that pharmacy is to present a challenge to such students for the use of their superior abilities. The need today is not for more students, but better students of pharmacy.

## VIII

### *The Financing of Pharmaceutical Education*

1. IT IS RECOMMENDED, as one of the principal implementation activities of The Survey, that carefully planned efforts be made to cause the administrative authorities to know and to understand the financial needs of the colleges and schools of pharmacy.

2. IT IS RECOMMENDED that the individual establishments comprising the business of pharmacy recognize and assume their direct professional and financial responsibility for the effective maintenance of the profession of pharmacy through the support of pharmaceutical education.

IX

*The Prescription Study*

1. IT IS RECOMMENDED that each college or school of pharmacy undertake to conduct periodic study of the prescriptions currently written in the area served by the institution. In view of the potential usefulness for pharmaceutical training, the services of students should be enlisted to the largest possible extent for such studies.

2. IT IS RECOMMENDED that the American Association of Colleges of Pharmacy create a standing committee, the duties of which should be (a) to develop uniform plans to be followed by the colleges or schools when making prescription studies; and, (b) to assemble and publish the results of the studies made by individual institutions. Such assembly of results should be made available to the medical schools of the country.

X

*The Pharmaceutical Curriculum*

1. IT IS RECOMMENDED that the recognized objectives of the undergraduate program for the education and professional preparation of pharmacists include:

A. SELECTING, SCREENING, and graduating those students possessing the technical abilities, personal character, and social outlook required for the practice of the profession of pharmacy.

B. PREPARING STUDENTS to procure, develop, prepare, preserve, standardize, test, and dispense substances and articles used in the diagnosis, treatment, and prevention of disease.

C. DEVELOPING ABILITY in students to utilize properly the Pharmacopoeia of the United States, The National Formulary, New and Nonofficial Remedies, and other recognized reference works on drugs.

D. GROUNDING STUDENTS in the principles and practices of organizing and administering a pharmacy.

E. MAKING STUDENTS fully conscious of the ethical standards to be met by the pharmacist.

F. QUALIFYING STUDENTS to cooperate with members of the other health professions and to consult with them; to furnish accurate, objective, and scientific information to physicians and members of other health professions concerning drugs and their action.

G. PREPARING STUDENTS to provide professional services to the public appropriate to the basic functions of pharmacy in its role as a health profession.

H. EQUIPPING and stimulating students to contribute to the profession by participating in its various organizational, literary, teaching, research, and other activities.

I. PROVIDING STUDENTS with an adequate foundation for graduate work in the various subjects of the curriculum.

J. PREPARING STUDENTS to assume the responsibilities of citizenship befitting professionals.

K. ENRICHING the life of the students through greater understanding and appreciation of the culture, values, and problems of our civilization.

2. IT IS RECOMMENDED that the American Association of Colleges of Pharmacy and the American Council on Pharmaceutical Education continue their efforts for the constructive betterment of the existing four-year program of education and training providing the essential knowledge and skills for the practice of pharmacy and leading to the degree of Bachelor of Science in Pharmacy.

3. IT IS RECOMMENDED that the American Association of Colleges of Pharmacy and the American Council on Pharmaceutical Education take the necessary initial steps for the development and establishment of a six-year program of education and training leading to the professional degree of Doctor of Pharmacy (Phar.D.), this program to include two or more years of general education and basic science training.

4. IT IS RECOMMENDED that the cooperative relationship of The Survey and the Committee on Curriculum of the American Association of Colleges of Pharmacy be continued for the purposes of: (a) improving the four-year program, and (b) developing a six-year program; and that in these two undertakings attention be given to the reports prepared by The Survey on instruction in pharmacognosy, pharmacy, physical sciences and mathematics, pharmacology and related sciences, microbiology and public health, and pharmacy administration.

5. IT IS RECOMMENDED that the American Association of Colleges of Pharmacy and the American Council on Pharmaceutical Education propose a plan whereby graduates in pharmacy who received other degrees in this field may become eligible for candidacy for the degree of Doctor of Pharmacy.



6. IT IS RECOMMENDED that financial provision be made whereby the American Association of Colleges of Pharmacy and the American Council on Pharmaceutical Education will be enabled to assume responsibility for the continued study of the program of pharmaceutical education and training in order that it may be kept abreast of educational and professional developments and social needs.

7. IT IS RECOMMENDED that those agencies of the profession of pharmacy concerned with the maintenance of professional education and training on a high level include in their program of service provision for the modernization of pharmaceutical textbooks as essential instrumentalities for effective and economical teaching.

## XI

### *In-Service Training for Pharmacists*

1. IT IS RECOMMENDED that each of the accredited colleges and schools of pharmacy recognize and assume responsibility for providing organized programs of in-service professional instruction of the practicing pharmacists within the area normally served by the institution, and to this end set up, under competent, professional direction, an operation unit to be known as the "division of pharmaceutical extension."

2. IT IS RECOMMENDED that the duties of such division of pharmaceutical extension include the development of refresher courses conducted at the institution, programs of reading, correspondence study courses, and the systematic visitation and personal counseling of pharmacists.

3. IT IS RECOMMENDED, in order to insure the maximum of cooperative effort, that the state boards of pharmacy of each state take the initiative for the creation in the state of a Pharmaceutical Extension Council consisting of the dean of the college(s) or school(s) of pharmacy, the director(s) of the division(s) of pharmaceutical extension, and representatives of the state pharmaceutical association and the state department of public instruction.

## New Books

**Pharmacy Forward**—by Frederick J. Wulling, Dean College of Pharmacy, University of Minnesota, 1892-1936. 1948. 123 pages. 20 full page illustrations. Edition limited to 500 copies. Edited and published by Emerson G. Wulling, The Sumac Press, La Crosse, Wisconsin. Price \$3.00.

When Frederick John Wulling died on October 21, 1947, there passed from our midst one of the most towering pioneering figures in the field of pharmaceutical education. His accomplishments are known to all of us who were privileged to share with him only a small part of his experiences. To the later generation which was not permitted to know him, the high lights of his accomplishments are recorded in the various volumes which are published to record the works of distinguished men.

The present volume, however, is different. It is a collection of incidents and experiences, many of them of a personal nature, such as a loving son would have collected in memory of a father whom he admired and respected. As I read it, I was inclined to think that Emerson compiled it for the pleasure it gave him to live over with his father the life of his boyhood. But, he did more than that, he made it possible for those of my generation to enjoy that experience also. And, in addition, the historically minded will gain a vast amount of history by the perusal of its pages, and will learn what it took for a young man to build a great institution in a great university in a great state, and what that man had to take to do it.

Mechanically the book, the paper, the printing, and even the jacket is a work of art, in keeping with the personality of Frederick John Wulling. We are grateful to Emerson, the son, for this personal contribution to our literature, and for the elegant way it was done.—R. A. L.

**Polio and Its Problems**—by Roland H. Berg with a Foreword by Basil O'Connor, president of the National Foundation for Infantile Paralysis, Inc. 1948. 174 pages, 24 illustrations. The J. B. Lippincott Company. Price \$3.50.

Here is a book that fills a great need, not only for the practicing pharmacist, but for the layman as well. It gives the story in

an amazingly readable form of the experimental studies that have been made to reveal the cause, the method of transmission, the means of control, and the methods of treatment of one of the most baffling of diseases, not even excepting cancer. The mortality resulting from infantile paralysis is low when compared to that of cancer and many of the contagious diseases, and does not justify the fear of it that is usually held. That fear is due to its crippling nature. The book closes with a discussion of the question "Is Crippling Necessary?", and states what can be expected in the future, and gives a final summation of our knowledge, all of which will be of the greatest value in the fight against the disease. A real service would be contributed to the cause of public health if more men qualified to interpret scientific knowledge about our major killers, to the public, would undertake to write books of this type about our major diseases.—R.A.L.

**Textbook of Pharmacognosy**, by Heber W. Youngken, A. M., Phm. M., Ph.D., Sc.D., Professor of Pharmacognosy and Biology, Massachusetts College of Pharmacy. Sixth ed., 1063 pages, 521 illustrations. The Blakiston Company, Philadelphia, 1948. Price \$8.50.

This book through former editions has established itself as a standard textbook and reference work in the field of pharmacognosy. In the preparation of the present edition, the author has done an excellent job in accomplishing his objective which is stated in the preface as being: "I have endeavored to take cognizance of—advances and changes and to bring the text into conformity with the best current pharmacognostical thought and practice."

Newer therapeutic agents of biological origin such as penicillin, streptomycin, tyrothricin, bacitracin, rutin, the digitalis glycosides, piscidia, the newer hormones and insecticides of plant origin, and the various plasma fractions of human blood are included. While planned primarily for the use of students in undergraduate pharmacognosy courses, sufficient material is included on characteristics, drug cultivation, microanalytical methods, etc., to make the book serviceable at the graduate level in pharmacognosy and to others interested in medicinal plants.

A number of monographs on some of the older drugs have been deleted or shortened. A large number of new illustrations have been added, and some of the older cuts have been replaced by better ones. The new material added includes a section on the structure, staining and mounting for microscopical examination of pollen grains; a section dealing with animal excreta in drugs, spices and food products; allergens and allergenic preparations; a new chapter on antibiotics and bacterial biological products; and a num-

ber of new microanalytical methods. A change which should be of considerable help to the student is the placing of the official synonyms in italics.

It has been said that this book is not suitable as an undergraduate text because its encyclopedic nature relegates it to the reference class and makes it to pharmacy what Dr. Asa Gray's book is to botany. This reviewer would welcome the appearance of a pharmacognosy text designed specifically as a tool for the teaching of pharmacognosy at the lower undergraduate level; one which would place a greater emphasis upon the pharmacy and pharmacology of these substances; and which would have a classification based upon the recognition that the customer's request in the drug store is a therapeutic or pharmacologic one, that the prescription fills a therapeutic need and that the stock is arranged accordingly. —W. R. B.

**Organic Chemistry with applications to Pharmacy and Medicine—**by Eldin V. Lynn, Ph. D., Professor of Chemistry, Massachusetts College of Pharmacy, 1948. Third ed., Thoroughly revised. 355 pages. Lea & Febiger. Price \$5.00.

This thoroughly revised third edition continues to fill the need for a textbook that reviews the basic reactions of organic chemistry and applies them to the substances used in medicine and pharmacy. The author adheres to his belief that " \* \* \* we cannot hope to learn more than reactions that are common to large groups. Any attempt to teach chemicals in place of chemistry in a relatively short time, is almost certain to be a failure. It would seem reasonable that the best approach must involve a thorough presentation of general principles and properties." The book has included the organic compounds of the U.S.P. XIII and N.F. VIII and many recently developed non-official chemicals of interest to pharmacy and medical students. The subject matter is presented with clarity, and seems to be well chosen and up to date. The questions at the end of each chapter are excellent as teaching aids. It is still the author's opinion that the chemistry book should not deal with physiological actions and applications in medicine and pharmacy. It seems an excellent opportunity is being missed to impress upon the student that the end-point of all synthesis in this field is to produce a compound which possesses a physiological action of value in the treatment of disease. This application is studied by the student in his other courses, but the foundation which could be laid at this time could serve as a basis for the correlation of the chemistry of these compounds with their use in medicine and physiological action.—W.R.B.

**Organic Chemistry—**by Hugh C. Muldoon, D. Sc., Professor of Chemistry; Dean of the School of Pharmacy, Duquesne University. Third

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Edition. 1948. 648 pages. The Blakiston Company, Philadelphia. Price \$5.50.

This third edition represents a thorough rewriting which has been expanded and modernized. "New features include an improved format, a different sequence of topics, an increased amount of tabulated information, a more generous use of equations and structural formulas, and numerous cross references. Discussions of theoretical matters have been simplified and sometimes extended, and additional information has been given concerning hetero-cycles, proteins, carbohydrates, antibiotics, vitamins, hormones, steroids, and other groups. Special attention has been devoted to modern chemical nomenclature." Material is given for a full year's course in organic chemistry for the beginning college student. Although the book is designed to meet the needs for pharmacy students, it will serve the needs of those preparing for medicine and dentistry. It is also recommended as a text for the shorter course in applied organic chemistry.—W.R.B.

**Drug Research and Development**—Edited by Austin Smith and Arthur D. Herrick, and authored by eighteen collaborators each distinguished in his field. 1948. 597 pages including bibliography. Revere Publishing Company. Price \$10.

The objective of the book is well stated by the editors when they say in the preface "Today the drug manufacturer and distributor, the research and laboratory worker, the physician and pharmacist, the advertising counsel and sales representative are all participants in the development of drugs and drug therapy. Collectively they deserve considerable credit for the remarkable advances that have taken place in the last decade. But, to take their rightful place in modern drug research, development and promotion each requires a working knowledge, not only of the tasks allotted to him, but also of the program as a whole and what it encompasses and entails. The purpose of this volume is to promote such an understanding and to present the essential background. The editors have sought to avoid a theoretical presentation of the subjects introduced. They have gone to industry, to the universities, to the professions for their contributors with the happy result that the various chapters are founded in actual experience and on practical material." The task has been well done.—R.A.L.

**Education for Professional Responsibility**—A report of the Proceedings of the Inter-Professions Conference on Education for Professional Responsibility held at Buck Hill Falls, Pennsylvania, April 12, 13, and 14, 1948. 1948. 207 Pages. Carnegie Press, Carnegie Institute of Technology, Pittsburgh. Orders should be sent to Rutgers University Press, New Brunswick, New Jersey. Price \$3.00.

# INSTITUTIONS HOLDING MEMBERSHIP IN THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY (Concluded)

## Nebraska

Creighton University, College of Pharmacy, Omaha, (1916)  
William A. Jarrett, Dean  
University of Nebraska, College of Pharmacy, Lincoln, (1913)  
Joseph B. Burt, Dean

## New Jersey

Rutgers University, The State University of New Jersey, New Jersey College of Pharmacy, Newark, (1923)  
Thomas D. Rowe, Dean

## New York

University of Buffalo, School of Pharmacy, Buffalo, (1939)  
A. B. Lemon, Dean  
Columbia University, College of Pharmacy of the City of New York, (1939)  
Charles W. Ballard, Dean  
Fordham University, College of Pharmacy, New York, (1939)  
James H. Kidder, Dean  
Long Island University, Brooklyn College of Pharmacy, Brooklyn, (1939)  
Hugo H. Schaefer, Dean  
Union University, Albany College of Pharmacy, Albany, (1945)  
Francis J. O'Brien, Dean

## North Carolina

University of North Carolina, School of Pharmacy, Chapel Hill, (1917)  
Marion L. Jacobs, Dean

## North Dakota

North Dakota Agricultural College School of Pharmacy, Fargo, (1922)  
William F. Sudro, Dean

## Ohio

Ohio Northern University, College of Pharmacy, Ada, (1925)  
Rudolph H. Raabe, Dean  
University of Cincinnati, Cincinnati College of Pharmacy, (1947)  
Luell Klotz, Dean  
The Ohio State University, College of Pharmacy, Columbus, (1900)  
Bernard V. Christensen, Dean  
University of Toledo, College of Pharmacy, Toledo, (1941)  
Charles H. Larwood, Dean  
Western Reserve University, School of Pharmacy, Cleveland, (1902)  
Arthur F. Wyss, Dean

## Oklahoma

University of Oklahoma, School of Pharmacy, Norman, (1905)  
D. B. R. Johnson, Dean

## Oregon

Oregon State College, School of Pharmacy, Corvallis, (1915)  
George S. Crossen, Dean

## Pennsylvania

Duquesne University, School of Pharmacy, Pittsburgh, (1927)  
Hugh C. Muldoon, Dean  
Philadelphia College of Pharmacy and Science, Philadelphia, (1900)  
Ivor Griffith, Dean  
Temple University, School of Pharmacy, Philadelphia, (1928)  
H. Evert Kendig, Dean  
University of Pittsburgh, Pittsburgh College of Pharmacy, Pittsburgh, (1900)  
Edward C. Reif, Dean

## Philippines

University of the Philippines, College of Pharmacy, Manila, (1917)  
Patrocinio Valenzuela, Dean

## Puerto Rico

University of Puerto Rico, College of Pharmacy, Rio Piedras, (1926)  
Luis Torres-Diaz, Dean

## Rhode Island

Rhode Island College of Pharmacy and Allied Sciences, Providence, (1926)  
W. Henry Rivard, Dean

## South Carolina

Medical College of the State of South Carolina, Charleston, (1940)  
William A. Prout, Director  
University of South Carolina, School of Pharmacy, Columbia, (1928)  
Emery T. Motley, Dean

## South Dakota

South Dakota State College, Division of Pharmacy, Brookings, (1908)  
Floyd J. Leblanc, Dean

## Tennessee

University of Tennessee, School of Pharmacy, Memphis, (1914)  
Robert L. Crowe, Dean

## Texas

University of Texas, College of Pharmacy, Austin, (1926)  
Henry M. Burlage, Dean

## Virginia

Medical College of Virginia, School of Pharmacy, Richmond, (1908)  
R. Blackwell Smith, Jr., Dean

## Washington

State College of Washington, School of Pharmacy, Pullman, (1912)  
Pearl H. Dirstine, Dean  
University of Washington, College of Pharmacy, Seattle, (1903)  
Forest J. Goodrich, Dean

## West Virginia

West Virginia University, College of Pharmacy, Morgantown, (1920)  
J. Lester Hayman, Dean

## Wisconsin

University of Wisconsin, School of Pharmacy, Madison, (1900)  
Arthur H. Uhl, Director



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## FELLOWSHIPS IN PHARMACY

To meet the demonstrated need for trained teachers and researchers in the field of pharmacy, the American Foundation for Pharmaceutical Education announces a limited number of Fellowships for students seeking graduate degrees in pharmaceutical subjects.

These Fellowships are open to students (men or women) qualified for registration in approved graduate schools (or colleges) for one or more of the following major fields:

**PHARMACY**  
**PHARMACEUTICAL CHEMISTRY**  
**PHARMACOLOGY**  
**PHARMACOGNOSY**  
(or closely related subjects)

Each Fellow will receive from the Foundation a stipend to cover the year of his appointment, plus an allowance for tuition and miscellaneous term bills. Fellowships are renewable for one year.

For further information concerning Foundation Fellowships, including application forms, write directly to the

**Board of Grants,**  
**AMERICAN FOUNDATION FOR PHARMACEUTICAL**  
**EDUCATION**

**330 West 42nd Street**

**New York 18, N. Y.**

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